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An Experimental Guide for Special Class Mathematics; A Curriculum Guide for Teachers of the Educable Mentally Retarded.

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Intended for the teacher of the educable mentally retarded, the guide uses three approaches to teaching mathematics: the systematic teaching of basic skills, the unit approach to apply skills and concepts from several subject areas to a common topic, and the incidental application of learned skills to current experiences. Structured by developmental rather than grade levels, the guide organizes developing quantitative concepts (level 1), learning the basic processes (level 2), applying the basic processes in solving realistic, practical problems (level 3), and relating mathematical knowledge to independent adult living (level 4). At each developmental level content areas include developing a vocabulary of quantitative terms, numeration, developing the arithmetic processes, and practical application of quantitative abilities. Suggestions are given for resource materials, techniques, and activities in each area at each level. (DF)

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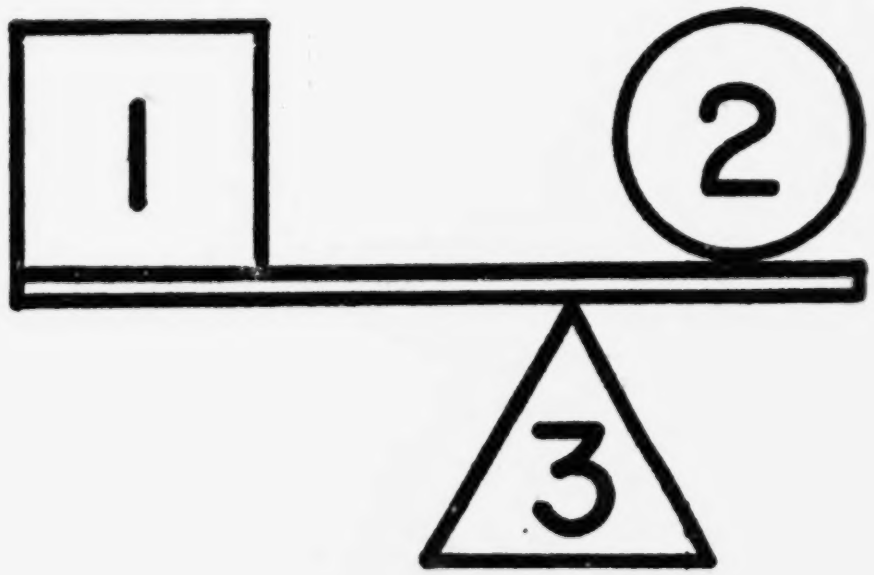
An Experimental Guide for Special Class

MATHEMATICS

a curriculum guide for

Teachers of

the educable mentally retarded



EC002358

Southeast Region Special Education Service Center

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AN EXPERIMENTAL GUIDE FOR SPECIAL CLASS - MATHEMATICS

A Curriculum Guide for Teachers of the Educable Mentally Retarded

Produced by:

Southeast Region Special Education Service Center

for

Thirteen (13) Participating Districts

ABC Unified School District
Bellflower Unified School District
Compton City School District
Compton Union High School
Downey Unified School District
El Rancho Unified School District
Enterprise City School District
Little Lake School District
Lynwood Unified School District
Montebello Unified School District
Norwalk - La Mirada Unified School District
Paramount Unified School District
Willowbrook School District

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MATHEMATICS FOR THE EDUCABLE MENTALLY RETARDED:

A TEACHER'S GUIDE

Purpose of the Guide. The ultimate goal of the school program for educable retarded students is preparation for independent living. The educator is, therefore, concerned with persistent life needs and must plan educational activities which will prepare the student so these needs can be met. This necessitates the learning of certain basic skills and developing the ability to apply these skills to practical life situations. At least three approaches are generally implemented in the teaching of retarded students: the systematic teaching of basic skills, the unit approach to apply skills and concepts from several subject areas to a common topic, and the incidental application of learned skills to current experiences. This guide attempts to utilize all three approaches. It is designed to identify the body of knowledge in mathematics which is essential to the personal, social and economic development of the studnet. Emphasis is given to to sequential development of mathematical concepts and skills. The teaching techniques which are suggested are designed to relate mathematics to practical needs.

Organization. Structuring subject areas by grade level is not appropriate for mentally retarded students. This Guide incorporates a "developmental level" approach. Thus, the student, regardless of his chronological age, may be instructed within a range which is appropriate for his developmental level.

Developmental levels are determined by the area of greatest emphasis. Certainly there will be overlapping from each level, but primary emphasis is given as follows:

Level	Emphasis
I	Development of Quantitative Concepts
II	Learning the Basic Processes
III	Applying the Basic Processes in Solving Realistic, Practical Problems
IVV	Relating Mathematical Knowledge to Independent, Adult Living

At each of the four developmental levels, content areas have been identified and tasks from each of the content areas are included at the appropriate developmental level. The general content areas are:

I	Developing a Vocabulary of Quantitative Terms
II	Numeration
III	Developing the Arithmetic Processes
IV	Practical Application of Quantitative Abilities

A. Time
B. Money
C. Linear Measurement
D. Liquid & Dry Measure
E. Weight
F. [illegible]
G. [illegible] Forms
H. Temperature
I. Problem Solving Devices

To promote efficient utilization, all content areas at Level I are presented, then all content areas at Level II, etc.

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10. Addition of fractions and decimals					
11. Applying addition facts to word problems					
12. Addition problems in life situations					

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12. Applying division facts to life situations				
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3. Fractional parts of cup, teaspoon, etc.				
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INTRODUCTION

VOCABULARY

Two questions face every arithmetic teacher: "What vocabulary should I reach?" and "How shall I teach it?" Arithmetic is written in a "foreign language". The words used in it are, too often, not the words the child uses outside the classroom. When they are the same words they sometimes have special meanings different from the common meaning. An example of this is the word "line" which means one thing in art, another thing in reading, another when coming in from recess, and still another in arithmetic. 'Draw a lot of curly lines," says his art teacher. "Draw a line under the word," she says in reading. "Make a nice straight line before we go into the room," she says on the playground. Is it any wonder the child is confused when he is told after years of this that a line has infinite length, but no width or thickness - cannot be drawn or seen or made.

The problems of vocabulary in arithmetic are still more complex for the teacher of retarded pupils. For that reason the assumptions upon which this vocabulary is based are listed below:

1. Increasing his vocabulary will help a child function better as he grows grows to adulthood.

2. Words are not taught by reading, or memorizing definitions.

3. A child needs to hear a word used in context many times, and become comfortable about using it in context himself before it has real meaning meaning for him.

4. A child will have a listening vocabulary which is more advanced than his speaking or reading vocabulary.

5. Words in this list with specialized meanings are defined, or used in context, or both.

6. Words that are underlined are words the average pupil already knows when he comes to class.

7. Words given at Level I are not repeated at Level II, etc.

Vocabulary is the first section of each level.

LEVEL I

P R O G R E S S R E P O R T

Level I

PROGRESS REPORT LEVEL I

	Counting			Number Concepts 1 - 10											
Pupils Names	Rote 1-10	Rational 1-10	Write Numerals 1-10	Match Numerals & Quantity 1-5	1-10	Reproduce the Quantity 1-5	1-10	Reproduce the Symbol 1-5	1-10	Recognize the Set 1-5	1-10	Number Words 1-5	1-10	Addition 1-5	1-10
Arron, Billy															
Blake, Leslee															
Carr, Mary															

1. Rote Counting - knows number names in correct order.
2. Ratical Counting - Has established a one-to-one relationship in counting.
3. Writing Numbers - Can correctly copy number forms.
4. Match Numeral and Quantity - Can select the numeral that represents the quantity in set.
5. Reproduce the Quantity - Can draw correctly the number of objects the numeral designates.
6. Reproduce the Numeral - Can recall and write the numeral that tells how many items are pictured.
7. Recognize the Set - Can select a specific number of objects from a larger set.
8. Number Words - Can recognize the number words one to ten eigher alone or in context.
9. Addition - Can find the answer to number stories with minuends to 6.

DEVELOPING A VOCABULARY OF QUANTITATIVE TERMS

Section I

Level I

I. DEVELOPING A VOCABULARY OF QUANTITATIVE TERMS - LEVEL I

A. DESCRIPTIVE TERMS

absent
block
big
cold
direction
fat
hot
less
little
long
many
much
narrow
round
together
thick
thin
wide
whole

B. COMPARATIVE AND MODIFYING TERMS

1. COMMON COMPARATIVE WORDS

deep, deeper, deepest
easy, easier, easiest
far, farther, farthest
fast, faster, fastest
few fewer, fewest
further
greater than
Hard, harder, hardest
heavy, heavier, heaviest
high, higher, highest
light, lighter, lightest (weight)
little, less, least
low, lower, lowest
more than
more than one
most
near, nearer, nearest
slow, slower, slowest
small, smaller, smallest
tall, taller, tallest

2. NUMBER WORDS

zero, one, two, three
four, five, six, seven
eight, nine, ten
eleven, twelve, thirteen
fourteen
fifteen, sixteen, seventeen,
eighteen, nineteen, twenty, thirty
forty, fifty, sixty, seventy,
eighty, ninety, hundred,
hundreds

VOCABULARY - LEVEL I

3. ORDER WORDS

first
second
third
fourth
fifth
sixth
seventh
eighth
ninth
tenth

after
last
next
next to last

4. WORDS THAT TELL "WHERE"

above
behind
below
beneath
between
east
far away
front
further
here
north
south
west

5. WORDS THAT TELL "WHEN"

after
before
day after tomorrow
day after yesterday
fall (season)
last night
last week
last year
next week
next year
spring
summer
today
tonight
tomorrow
winter
yesterday

6. WORDS THAT TELL "HOW MANY" OR "HOW MUCH"

all
all of
altogether
both
bunch
class
crowd
dozen
each
every
group
no (quantity)
none
not any
nothing
not so many
pair
several
set
some
some of
team

C. TERMS RELATED TO MATHEMATICAL PROCESSES

abacus - a device made of beads strung on a wire or wires, used in teaching counting or place value arithmetic. A place value abacus usually has one wire for each place in the place value system being taught.

accurate - exact as compared to approximate.

add
addition
answer

arc - a part of a circle. "The arc of the rainbow..."

calendar
cent, cents

center - of a circle: the point which which is an equal distance from all points on the circle.

circle
clock
coin, coins

collect - to bring together for a purpose. "Bill, please collect the milk money."

collection - objects united from the viewpoint of a common property as in "a collection of stamps" or "the collection of things the boy carries in his pockets".

VOCABULARY --LEVEL I

C. TERMS RELATED TO ... (Cont'd)

compare - to determine like and unlike qualities or quantities between objects, groups of objects, numerals, or other symbols.

construct --to draw a figure according to certain stated requirements. More commonly used at this level to mean: to make something.

construction

correct - being free of error as "That is the correct answer". Also used to change error to truth as in "Correct your work".

cost
count

count by -- used to indicate the counting intervals in counting as in "Count by twos to ten".

counting numbers
date
day
difference - the answer in subtraction. "The difference between 3 and 2 is 1".

dime
distance

divide - to separate a set into equal sub-sets. This can be done when either the size of the subsets or the number of subsets is known.

dollar

edge
example

half-dollar
height
how many
how many more

left (direction) "This is my left hand".

line - commonly used to indicate one pupil behind another as in "Make a nice straight line before we go into the room". Technically, something straight with infinite length in two directions, no width and no thickness.

measure, measurement
mile
mileage
minute
money
month

nickel, nickels
no (quantity) "We have no paper".
number

VOCABULARY - LEVEL I

C. TERMS RELATED TO ... (Cont'd)

one-half (of a whole) as in "He gave me half his apple".

price
problem

right - (correct) "He has the right answer".

right - (Direction) "Raise your right hand".

row
ruler

set - any group, family, collection, etc. "Peter has a set of colored pencils".

square (geometric figure)

teaspoon
tablespoon
temperature
time
total
triangle
twice
twice as much

value

week
weight
wide
width

yard
yardstick

N U M E R A T I O N

Section II

Level I

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL 1
II. NUMERATION A. COUNTING WORDS IN ORDER ORDER 1. Rote Counting to 10	Malinda Dean Garton - Teaching the Educable Mentally Retarded Charles C. Thomas Co. Mary N. Ambrose - Happy Way to Numbers John C. Winston Co. Leila Armstrong - Come and Count Follett Publishing Co.	Number interests should be aroused and retained by various games and activities. 1) Counting & recording the milk order each day. 2) Counting the number of chairs & books needed for a group activity. 3) Counting the number of children that are present & absent each day, also the number of children in each row or at each interest center. 4) Let the children also count rhythmically, as counting to four and repeat in marching & clapping in time. Then have them march or clap the rhythm saying the four aloud. 5) The children count the taps the teacher makes with a pencil or ruler. First aloud with the teacher, then individually. Finally, silently telling only the total times the teacher tapped. 6) Have the children listen to the teacher tap, then have them clap the same number of times. 7) The children enjoy number stories, nursery rhymes and songs in which counting is involved such as the following: One for the Money One for the money, (Hold up one finger) Two for the show, (Hold up two fingers) Three to make ready, (Hold up three fingers) Four to go. (Hold up four fingers) - Anonymous Hickory, Dickory, Dock! Hickory, Dickory, Dock! (Raise the left arm over the head to represent a tall clock) The mouse ran up the clock; (Raise the right hand & let the fingers imitate a mouse running up the clock) The Clock struck one, and down he ran. (Clap hands as one is said, then let the fingers imitate the mouse running down) Hickory, Dickory, Dock! - Mother Goose

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

2. Developing Concepts Related to Counting

Two Little Blackbirds

Two little blackbirds sitting on a hill. (Use both hands, close fists, thumbs up)
One named Jack and one named Jill, (Waggle thumbs)
Fly away Jack! (Move right hand behind back)
Fly away Jill! (Move left hand behind back)
Come back Jack! (Bring right hand in front)
Come back Jill! (Bring left hand in front)
Two little blackbirds sitting on a hill, (Closed fists with thumbs up bobbing in front of child)
One named Jack and the other named Jill. (Waggle thumbs)

- Mother Goose

Five Little Squirrels

Five little squirrels sitting in a tree, (Hold left hand up, fingers limp from the wrist)
This little squirrel says "What do I see?" (Begin with thumb & hold up a finger as each squirrel is named)
This little squirrel says, "I see a gun."
This little squirrel says, "Let us run."
This little squirrel says, "I'm not afraid."
This little squirrel says, "Let's hide in the shade."
Along came a man with a great big gun. (Right hand moves up as finger points in imitation of a gun)
Bang! See those little squirrels run. (Clap hands & hide left hand)

- Anonymous

The children may sing "Ten Little Indians", then dramatize it. The child at the head of the line is named one, the next two & etc. As the children sing the song & name the numbers, Child One will step forward & back in place in the line. As the children sing about two, Child One takes the hand of child Two & they both step forward & back. This is done for each number as the song proceeds.

The teacher must be careful to emphasize the idea of one, the group of two, or the group of three. Each activity should show the value of one, two and three. The children must not be allowed to confuse number values with ordinal values of first, second or third.

CONTENT

RESOURCE MATERIALS

Manipulative Materials

Books
Disks
Pegs
Chairs
Shells
Desks
Blocks
Nuts
Seeds
Paper cups
Paper clips
Clothes pins
Paper plates
Tongue depressors
Colored art paper
Full length chalk
Dowel sticks
Rhythm sticks
Clay objects
Paper mache' objects
Picture postcards
Pop bottle caps
Tinker toy parts
Rulers
Pencils
Spools
Erasers
Crayons
Buttons
Pebbles
Marbles
Toy money
Small toys
Soda straws
Paste sticks

Number Symbol Cards

Emery Kinesthetic Number Cards

Directions in Making Cards

1. From any hardware or dime store buy medium or course-grained black emery paper. Buy either one $8\frac{1}{2}$"x11"

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

Manipulative materials are those which can be actually handled by the child. These are regarded as the most effective way to present the lessons. The more manipulative materials the teacher provides for each lesson, the greater the understanding of the children will be. The teacher is urged to plan ahead and list the materials that will be needed for the following week's and make every effort to see that they are available.

Use objects which are readily available & may be used for counting or grouping or for dramatizing number situations.

A set of ten number synbol cards is needed for teaching and practicing recognition of the number symbols from 1 to 10 It is suggested that 6" x 9" cards be used. Place large numbers on these cards with a dark wide-tipped lettering pen.

In every number class there are children who will have difficulty in writing numbers well. Many of the children have poor muscular coordination. Some of these & others will have reversal difficulties.

Much of this difficulty in writing numbers can be corrected with a set of emery kinesthetic number cards. When the child writes numbers poorly, take his forefinger & guide it over the rough surface of the number sever times. The rough surface of the emery numbers permits the child to

CONTENT

RESOURCE MATERIAL

sheet, or a package of twelve $4\frac{1}{2}$"x$5\frac{1}{2}$" sheets. The latter size is preferable if the package is available.

2. Make patterns of the numbers 1 through 10 three inches long and one-half inch wide.
3. Cut out the numbers you have traced.
4. Turn the emery paper over to the back smooth side and trace the numbers. Be sure the numbers are traced backwards. This is necessary so that when a number has been cut out & turned over to the rough side, each figure will be facing correctly. Extra sheets of emery paper can be used to make kinesthetic alphabet letters.
5. Be sure to make two ones since one will be needed for the card to show 1 and the other for 10.
6. After the numbers have been cut out, turn them over so the rough surface is up. Mount each number on a 6"x6" heavy tag board or bristol board.

The uses of all the above mentioned materials help to structure meaning for the child. The muscular activities used in touching, lifting, pushing & moving objects contribute immeasurably to the retention of the idea of the value of a number.

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

feel form & the direction of the strokes of the number he has difficulty in writing.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
B. CONCEPTS OF ONENESS, TWONESS, ETC.		
1. Concept of One	Liquid Duplicating Workbooks Hayes - Numbers for Beginners Continental Press - Playing with Numbers We Work with Numbers Glen-Sten - Fun with Numbers	A method of presenting the idea of one is to give directions to the child, using the term at every opportunity; such as: a) Move one chair away from the table. b) Bring one sheet of paper to the desk. c) Give one pencil to Sue. d) Give each pupil one napkin. e) Pick up one block, lay it on the table. f) Give Tom one block. g) Mary, take one block out of the box. h) Bill, I will give you one block. i) Now you give one to Sue. Encourage the child to respond by replying, "One block," or "Here is one block," or "Thank you, for one block." The teacher should not insist on complete sentences in reply as this may frustrate the child and keep him from thinking about the basic question.
2, Presenting the Symbol for One		Suggestions for presenting the cardinal number 1: a) Have each child bring one object to the front of the room as you call his name. Ask the child how many he has. If he replys the teacher writes a large 1 on the board, if he does not reply the teacher says, "You have 1," and draws a large 1 on the board. The line should be thick & several inches long. The teacher then hands the chalk to the child & tells him to write the number of the object he has brought. The teacher helps the child make the symbol if necessary. Then all the children write "how many" in the air with their fingers. They should say the name. It is important that the teacher watch the child make each number on the board several times to be sure that the child understands how to make it correctly. When the teacher is sure that the child understands how to make the symbol he should be given a piece of paper & a pencil & should practice making the number. b) Draw the number 1 on clay in the clay pan & let the child trace over it with a stylus.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

3. Teaching the Concept of Two

c) Draw 1 on the board. Nearby have pictures of many single objects such as; 1 apple, 1 cat, 1 dog, 1 peach, 1 orange, etc.; also 2 dogs, 3 seals and 2 balls. Ask the children to bring the pictures of just one object and line them up on the chalk tray under the number 1. Have them say, "One ---"

d) Another time give the children a piece of paper & have them write 1 and draw one object such as a ball and color it.

When the concept has been established use the duplicating material to re-enforce the learning.

Understanding of the number values may be intensified by the teacher's use of auditory training: clap the hands; sound a bell; tap on the desk; sound a note on the piano; at the same time naming the action or object in connection with the number being presented to the child; such as one ring, or one tap, etc.

The children may make of plastic clay such objects as 1 ball, 1 potato, 1 egg, etc. Make a large number 1, also of clay, & arrange the other objects around it.

As confidence increases and the child uses one with meaning, two may be introduced in the same manner as one was presented. The teacher should use the same materials and proceed through the same steps. She will insist that the child repeat the name of the object or action, such as two blocks, two dots, two marbles, two bounces of the ball. This precaution will prevent a fixation that connects any number with an object.

Let us look around the room to find as many things of which there are two alike. Let us start with the 2's we can find on Billy. (2 eyes, 2 ears, 2 hands, 2 arms, 2 legs, 2 feet) What other 2's can you find in the room? (2 hands on the clock, 2 covers on a book, 2 doors, etc.)

Use the flannel board -- Place along the chalk tray objects of one and two that are mounted to stick. Have the children choose the pictures that have two objects & place them on the flannel board. Have some of the

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
4. Presenting the Symbol for Two		pictures contain two different objects so the children will become aware that two different objects can be a set of two. Hold up the card showing the symbol two. See this number. The number on this card is two. When you see this number, call it two. It means two things. Hold up the card with the symbol 1. Ask, "What do we call this number?" What does it mean, Yes, it means one thing. Show either the number card 1 or the number card 2. Ask the child to bring you the number of objects the number on the card means. The teacher will make the number 2 very large on the board, emphasizing where to start & the direction in which to move. Then several children should go to the board to make 2's. If the group is small all of the children may go; if there are more children than board space will accommodate, send the more capable children first, so those children who are less successful in writing can watch successful efforts before they try. The teacher should observe each child write the number so that she is sure he understands the correct way to form the number. Each child should then be given a large piece of newsprint paper. Have the children fold it in half & then in half again. Some children will need help in doing this. Using both sides of the paper the children will draw eight pictures with two objects in each picture. The pictures may be animals or any object the child chooses. Make a large 2 beside each picture. The teacher will prepare a chart using some of the children's pictures. The best pictures can be placed in a number scrapbook made for the library table. Encourage the children to draw large pictures. Be sure & repeat the directions several times. Check to be sure that all of the children understand & are particpating in the activity. A repeated design is a good way to impress the number symbol & the amount on a child's memory. Give the children a paper that is folded into fourths. Use only two colors

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
5. Teaching the Concept of Three		Help the children learn poem about one and two. TWO LITTLE EYES Two little eyes that open and close, Two little ears and one little nose, Two little cheeks and one little chin, Two little lips with the teeth closed in. To help the children find 3's readily about the room, arrange objects in 3's before they come to the classroom. Remove all but three erasers, have only three pieces of chalk on the chalk tray, arrange only three pictures on the bulletin board. Place 3 disks, 3 tongue depressors, 3 sticks, 3 pencils, 3 paper circles, etc., on tables & desks. When number time comes have the children look about the the room to find as many groups of 3 things that are alike. The concept of three is so much more difficult than that of one or two for the child to understand that it will take much longer for him to assimulate the meaning and it will be necessary to make many more presentations. A variety of objects may be collected by the children and used by the teacher to stimulate interest and understanding.
6. Presenting the Symbol for Three		An excellent way to present the concept of three is the story of The Three Little Pigs, told on the flannel board Also, the story of Goldilocks and the three bears. Be sure to emphasize 3 bears, 3 bowls, 3 chairs, 3 beds. Place a large 3 at the top of the flannel board. Have many objects along the chalkboard tray or on a table already backed with flannel. There should be more than enough of each thing to make the groups of three. Tell the children this number is 3. It means three thing. When you see this numeral you will call it three. Have a child make a group of 3 things under the numeral. Plan practice lessons in the formation of numeral 3. Use board work prior to having the children write on paper.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

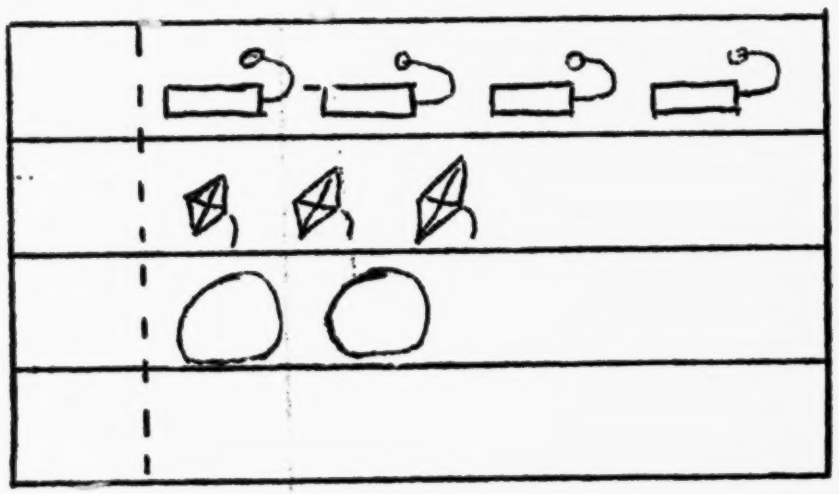
Have the children draw three balls on the board and number each one. Be sure to show the children how to write the number.

Go around and around
What can it be?
This is the numeral
Known as three.

Ask the children to watch as the teacher makes a large 3 on the board. Note the direction the chalk moves and note that the number is like two circles, not quite complete. Each part of the 3 is round.

Let the children work at the board until they are able to make well rounded 3's. Have them make a clay 3 and three clay objects to put around it.

Give each child a piece of paper and have them draw & color a picture of just three things. Make nice big things in your picture. The best pictures will be put in our number scrap book & on our chart of 3's. Listen carefully while I tell you again what to do.



Prepare duplicated papers as shown above. Give these directions.

Put wheels on three wagons. Color them.
Put tails on two kites.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
7. Emphasizing the Numerals Numerals 1 through 3		Draw a face on one moon. Make three trees. In each row write the numeral that tells how many. Blindfold one child and have him stand before the emery kinesthetic number cards 1, 2, 3. Gently guide the child's finger over the configuration of the numeral. Ask him to tell what numeral he has traced. Continue the activity; use the numerals 1 and 2 as well as 3.
8. Testing for Readiness for a New Concept		The child now knows the oral and written forms for 1, 2, 3. He recognizes or selects 1, 2, 3 objects as directed. Now the teacher should particularly observe the child's ability to understand these groups before advancing to the next number. There are maturity levels of comprehension for numerical values of a group of objects. Unless the child has the readiness for this process, it is useless to try to force comprehension.
9. Teaching the Concept of Four		Show me these things in our classroom: 4 children, bring them to the front of the room & count them. 4 crayons, take them out of your box & count them. 4 books, bring them to the chalk tray & count them. Sue hop four times (pick a child that can hop) Tommy clap four times. Billy jump four times. Mark tap the triangle four times. Mary ring the bell four times. Bobby take four steps. Jane name four girls you know. Ralph name four boys you know. Who has four in your family? Name them. etc.

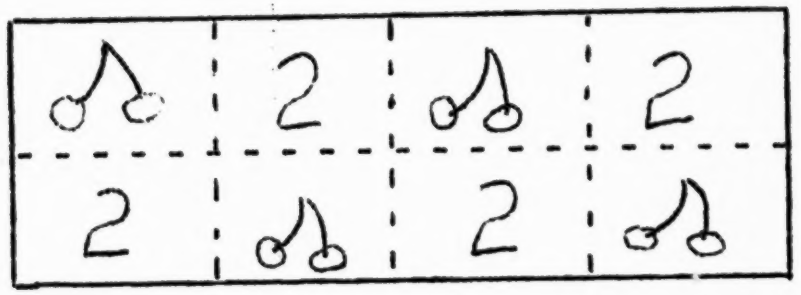
CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
10. Presenting the Symbol for Four		The teacher will make a large four on the board as she says; Down halfway and then go right, A tall straight stick and 4's in sight. Have the children note that the lines of the four are straight, not slanted, and are made with a quick downward stroke just like the numeral 1. Have the children work at the chalkboard so the teacher can see the movement as well as the finished number. Do not allow the child to write the number on paper until he has shown that he knows how to make the numeral accurately. Place the numbers 1, 2, 3 on the flannel board. Have the children place the correct number of objects under each numeral. Have the children draw the pictures of four objects for the number scrapbook and the 4's chart. Play a game with the children. Use a variety of large cards with pictures of sets of 1, 2, 3 and 4. Be sure that the sets are arranged in different patterns. Hold up one card. Tell the children that they must tell how many there are on the card without counting. Continue the activity mixing up the cards. Build up the speed in flash recognition of the sets by slowly cutting down the time of exposer. The activity can be varied by having the children write 1, 2, 3 and 4 on separate 3"x5" cards. Have them lay them on their desks numeral side up. The teacher holds up the card. When the child thinks he has the correct number he holds up the numeral for the teacher to see.

CONTENT

RESOURCE MATERIAL

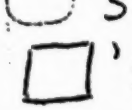
SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

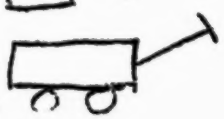
to make a repeated design; two objects & the number 2.



On the chalkboard write simple pictorial directions. Have the children draw pictures & label each picture with the correct numeral.

DRAW 2 red 's

DRAW 2 blue  's

DRAW 1 green 

Tell a flannel-board story about two children who went for a walk in the woods. They brought back these things they found on the way; 2 leaves, 2 acords 1 bird's nest, and 2 seed pods. Have the children place felt backed pictures on the flannel board as the story unfolds. When the story is completed, have some of the other children place the correct numerals under the objects.

CONTENT	RESOURCE MATERIALS	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
11. Teaching the Concept of Five		Again use the objects in the classroom to demonstrate the quantity of five. The teacher may ask to be shown: 5 fingers on your hand; 5 pieces of chalk; 5 books; etc. Patty skip 5 skips; Jack draw 5 balloons on the board; Betty hop 5 hops; etc. Have the children place 5 objects on the flannel board. Be sure to repeat the concept until there are very few mistakes in showing the correct quantity.
12. Presenting the Symbol for Five		When the child has the concept of the number value and is familiar with the oral name of the number, the visual symbol may be presented. Watch me as I write 5 on the board (Write a big 5 saying as you do so)"Numeral 5 has a round fat tummy, with his hat on he looks so funny". This gives the children a descriptive phrase to help them get a mental picture of the symbol they are to write. Have the children trace the numeral in the air. Face the same direction the children are facing and, with the arm extended to the side, show the children how to do this. Tell the children to think, down and around and now a line as they write. Plan practice lessons in the formation of the numeral 5. Have the children work at the chalkboard before they write on paper.
	Teacher made ditto sheets	Prepare a page of dotted 5's for the children to trace. Place an x where the child is to begin. Give these directions to the children twice. With your pencil write over all the dotted 5's on this page. When you have finished, you may write over each number again with a colored crayon.
	Emery-paper numerals	If the child has difficulty with the form have him trace the emery paper kinesthetic copy of the numeral 5.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

(Chalkboard Assignment) On the chalkboard you see 5 clown hats. On each hat you see a numeral. Draw these hats on your paper. Instead of writing the numeral on the hats trim your hats with that number of different colored dots.

Squares of Colored Paper

Provide for the children 2 inch squares of colored paper from which they will cut 5 balloons, and mount them on another piece of paper. Let the children make 5 beach balls, 5 kites, selecting colors as he chooses. Have the children number the objects on each paper. Add some of them to the number scrap book.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
13. Teaching the Concept of Six		By the time a child is ready to work with sets of six he has probably learned to count at least through five. It is mainly this technique of counting on which he will depend as he determines how many objects are in a set of more than five. The child may already know the name for the numbers that come after five. The teacher must keep in mind, however, that unless the child understands the concepts involved, his learning is reduced to a mere number-name recitation or exercise. Class procedure: The teacher would ask the boys and girls to show 6 crayons; 6 desks, etc. Peggy walk 6 steps, Billy knock 6 times; Dick bow 6 times; Mary clap 6 times; etc. Place six apples on the flannel board. Have the children place a number under each apple, and then tell how many there are. Tell the children they may use any of the objects to form groups of six on the flannel board. Place the numeral 6 at the top of the easel and leave it as the children manipulate the pictures. Note that there may be six ones; one and five; two and four; three and three; four and two; or five and one. Six is made up of smaller groups. It is hard to see six without counting unless we see these smaller groups to help us. The best way to show these groups is by putting yarn around the numbers named on the flannel board. It is not expected that the children will remember these combinations now but this useful discovery will be used later.
14. Presenting the Symbol for Six		Watch me as I write 6 on the chalkboard. Say as you write; "Pull the line down and then go around, It is the numeral 6 that we have found." Let us all write 6 in the air. Face the same way as the children are facing and with the arm extended to the side, show the children how to do this.

CONTENT

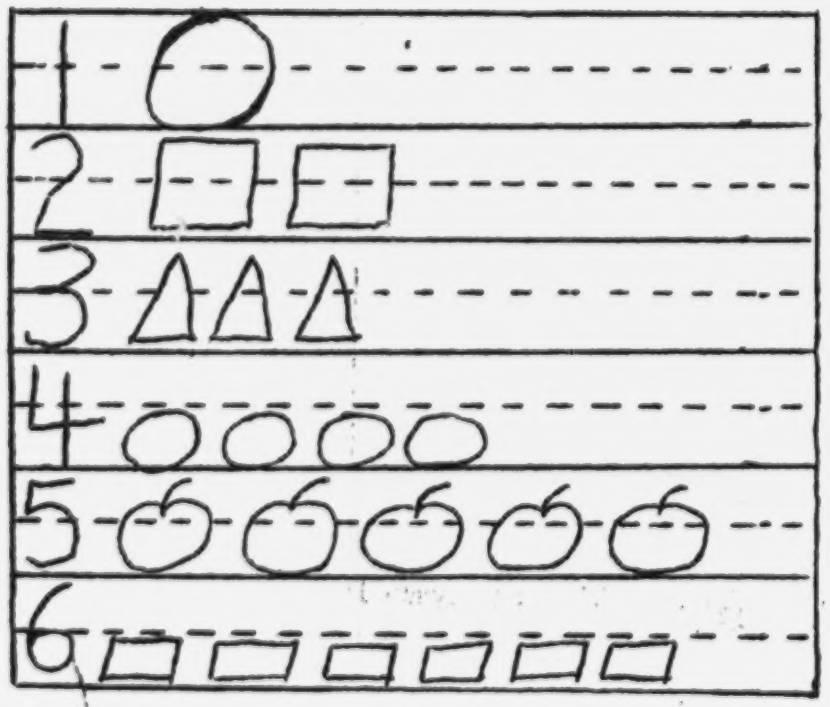
RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

Plan practice lessons in the formation of the numeral 6. Have the children work at the chalkboard before they write on paper. If any of the children are having difficulty in writing the numeral have them trace the emery-paper kinesthetic copy of the figure 6. Have him trace, then try to write, trace and then write until he understands the form. Think, "Down and around and close to make a loop," as you write it.

Fold a strip of wide-ruled writing paper to have six spaces. In each space write a neat, well-formed numeral 6. Mount this row of 6's at the bottom of a sheet of drawing paper. Above this strip have the children draw six objects, anything the child may choose. Use some of these in the number scrap book.

On wide-ruled writing paper write the numbers we have studied. Beside each draw a design showing the meaning of the numeral:



CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		Give the children continual practice with sets whose numbers are not more than six. Write a numeral from 1 to 6 on one end of each of several tongue depressors. Place the sticks, numeral end down, in a container. Ask a child to come forward and choose a stick, to read the numeral on the end of it, and to build on the flannel board a set of objects that corresponds to the numeral. Play a checkroom game. Distribute felt numerals 2 through 6. Have one child be the checkroom operator. The checked articles will be set-cards two through six, placed on a table next to the flannel board. Children with numerals will come to the checkroom operator, one at a time, to claim their articles. The checkroom operator will give the claimant a set card which corresponds to the felt number he shows. The claimant then places the numeral and the set card on the flannel board for the class to see. If the class finds that the checkroom operator made a mistake, the claimant becomes the operator and finishes checking out the articles. When all setcards and numerals have been matched, distribute the numerals to children who had no chance to participate in the game before. Choose a new checkroom operator, and continue the game.
15. Teaching the Concept of Seven		Show me these things in our classroom: 7 desks; 7 pieces of paper; 7 books; etc. Mary tap with your pencil 7 times. Joe walk 7 steps. Tony draw 7 crosses on the blackboard; etc. Have one child arrange in order on the flannel board sets whose numbers are less than seven. While this activity proceeds, have the children use counters and build these same sets at their desks.
16. Presenting the Symbol of Seven		Write a big picture of 7 on the chalkboard. Say as you write; "Across the top and down we go, The numeral 7 now we show." Let us all write 7 in the air. Face the same direction the children are facing and with the arm extended to the side show the children how to do this. Tell the children to think, "Over and down," as you write.

CONTENT

RESOURCE MATERIAL

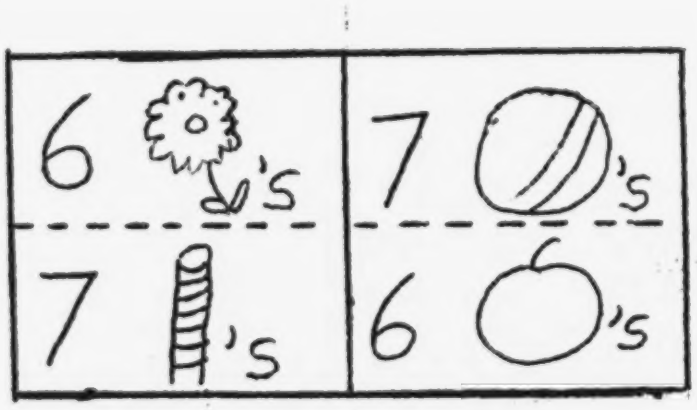
SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

Use board work prior to having the children write on paper. If reversals are observed use the tracing of the emery-paper kinesthetic copy of the figure 7 to help the child.

Have a page of dotted 7's for the children to trace. First have the children trace them with their pencils and then go over them with crayons.

Use the flannel board. Have a child come to the chalkboard and write a numeral from 1 to 7, then have a child build a set of that many objects on the flannel board. The other children can build a set of counters on their desks.

Chalk board Assignment: On the chalkboard you see something to draw in each box on your paper.



CONTENT

RESOURCE MATERIAL

Flannelboard
Sets of objects such as apples, stars, trees, balls, flowers, cats, hearts, balloons, etc.

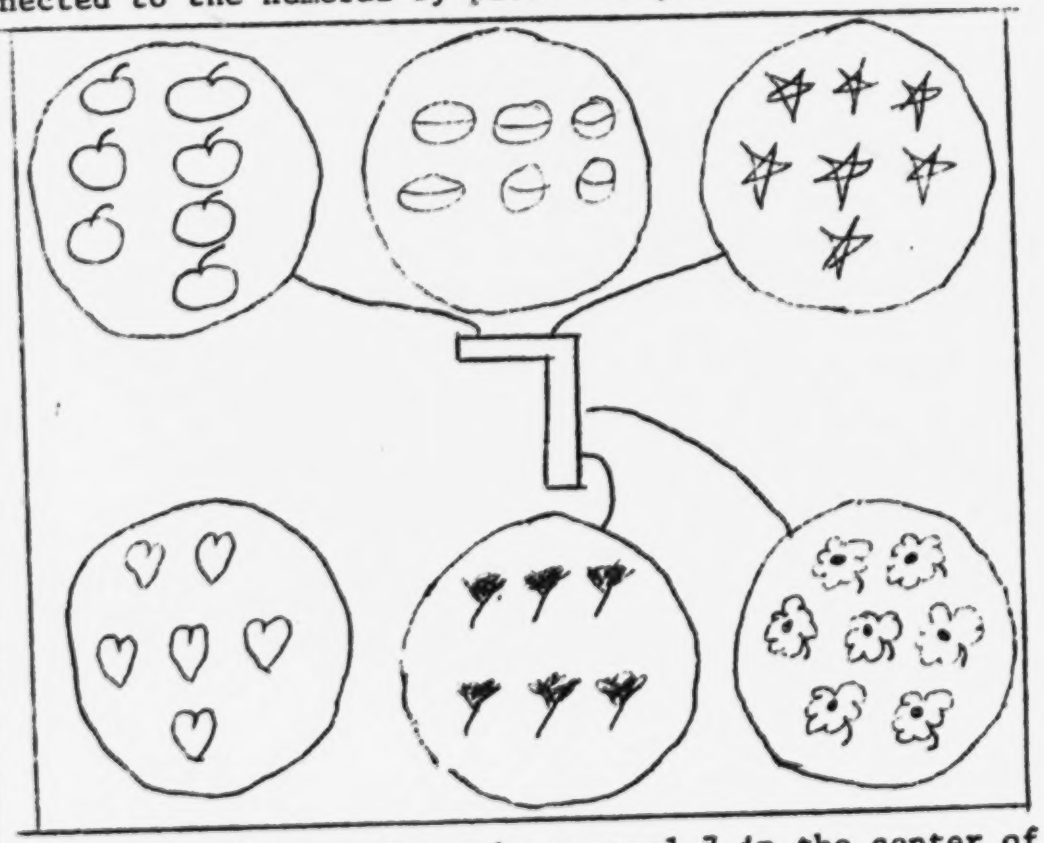
Short pieces of yarn

Felt numeral 7

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

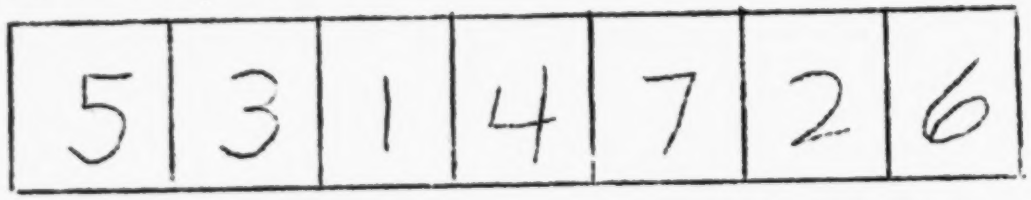
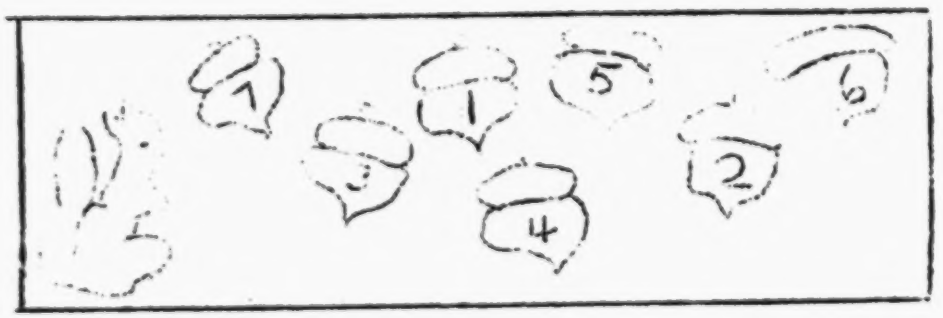
Here in the center of the flannel board I have placed the numeral 7. I am going to make a circle of yarn here at the edge of the flannelboard, "Mary, place seven apples in the circle." I will make another circle, "Billy, come place six hearts it it," etc., until the flannelboard is full of sets of six and seven. Then have the children connect the numeral with any set whose number corresponds with it. Have the children continue to do this until all the sets of seven have been connected to the numeral by pieces of yarn.



Have the children place the numeral 7 in the center of a large piece of paper and draw a set of seven objects about it. Use the best ones for the number scrapbook.

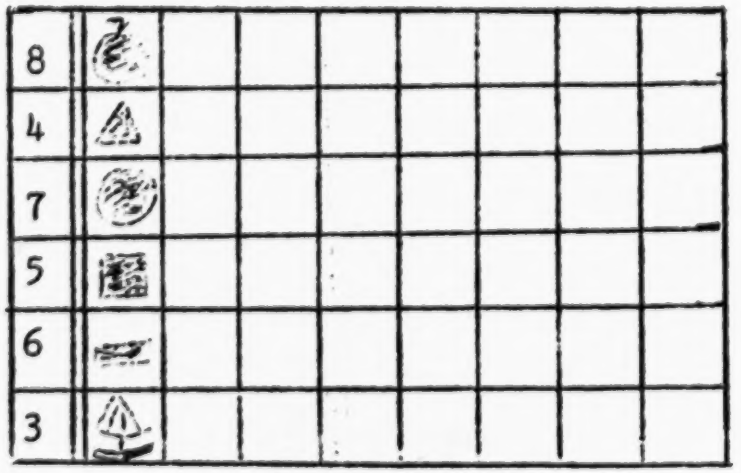
Plan practice lessons in the formation of numeral 7. Use board work prior to having the children write on paper. Have the children draw sets of seven on the chalkboard and label each set with its numeral. As each child makes a 7 on the board, have the others say;

Across the top and down we go,
The numeral seven now we show.

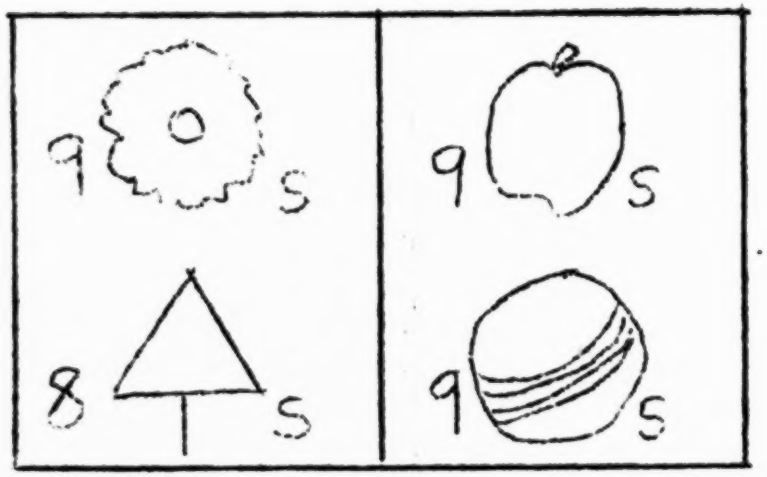
CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL 1
		After the boys and girls are sure of the numeral seven there should be much practice in the order of the numerals.
		Place the numerals 1 through 7 in scrabled order in the latticework frame on the flannel board. (The latticework can be made of tagboard or yarn.) Have one child come to the flannelboard and unscramble the numerals. Repeat the activitiy several times.
		
17. Practicing the Order of the Numerals	12" Strip of Tagboard latticework Flannelboard Felt Numerals 1 through 7 Seven tagboard acorn and one tagboard squirrel fixed to adhere to the flannelboard.	Another good flannelboard game is Squirrel and Nut. In a random manner on the flannelboard place seven tagboard acorn on which has been written the numerals 1 through 7. Give some child in the group a tagboard squirrel. Tell the child that he should help the squirrel nibble at each acorn in order. The squirrel is placed by each acorn in order beginning with 1. Encourage the child to say, "The squirrel nibbles on acorn one, then he nibbles on two, etc.
		

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
7. Emphasizing the Numerals Numerals 1 through 3		Draw a face on one moon. Make three trees. In each row write the numeral that tells how many. Blindfold one child and have him stand before the emery kinesthetic number cards 1, 2, 3. Gently guide the child's fingers over the configuration of the numeral. Ask him to tell what numeral he has traced. Continue the activity; use the numerals 1 and 2 as well as 3. The child now knows the oral and written forms for 1, 2, 3. He recognizes or selects 1, 2, 3 objects as directed. Now the teacher should particularly observe the child's ability to understand these groups before advancing to the next number.
8. Testing for Readiness for a New Concept		There are maturity levels of comprehension for numerical values of a group of objects. Unless the child has the readiness for this process, it is useless to try to force comprehension.
9. Teaching the Concept of Four		Show me these things in our classroom: 4 children, bring them to the front of the room & count them. 4 crayons, take them out of your box & count them. 4 books, bring them to the chalk tray & count them. Sue hop four times (pick a child that can hop) Tommy clap four times. Billy jump four times. Mark tap the triangle four times. Mary ring the bell four times. Bobby take four steps. Jane name four girls you know. Ralph name four boys you know. Who has four in your family? Name them. etc.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL I
		on which appear the numerals 1 through 8. Have one of the children place his boy doll on the flannel board. Have him ask "Who can be my partner?" The child who has the numeral to label this set will put the girl doll next to the boy doll with the set picture. Make a child with a girl doll place the numeral on the board and ask, "Who can be my partner?" Then the child with the corresponding set picture will come forward and place it next to the numeral. If there are not enough children to give out sixteen dolls, begin with three or whatever number will work out.
	12"x18" pieces of Manilla paper	Give each child a 12"x18" piece of Manilla paper marked off into 2" squares. Show the children what they are to do by drawing a diagram on the chalkboard similar to the one below. Explain that they are to read and follow the directions that are given for each row. That each row will begin with the numeral. It is best to show this on another piece of paper as the transfer of learning is difficult.



CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
	Triangle or Wood block assortment of felt objects and a set of felt numerals 1 - 8.	Direct the children to listen and count very carefully to the selves as you tap a specific number of times on a wood block or triangle. No one is to say the number. This must be stressed. Call upon one child to build a set on the flannel board that has the same number as the set of taps he has just counted. Have another child select the corresponding numeral to place beside it.
21. Teaching the Concept of Nine		Show me these things in our classroom: 9 desks, 9 books, 9 crayons, 9 beads on the abacus, 9 pieces of art paper, etc. Billy tap this triangle as many times as a clock would strike at 9 o'clock. Jean walk 9 steps. Mary clap 9 times. Have the children count aloud as they show or do each thing.
	Flannel Board set-card 1 - 9.	Play the game "I SPY". Place 5 or 6 set-cards on the flannel board. Tell the children that on the board you apy a set whose number is more than six. A child who thinks he has found the set which you are thinking of may describe it. To continue the game allow the child who identified the set to "spy" the next set. Change the set-cards often, so that the children must be alert in order to find the correct set.
		Have the children draw sets of nine objects for the number scrapbook.
		Chalkboard Assignment: Direct the children how to fold a sheet of 12"x18" newsprint into fourths. On the blackboard you see something to draw in each box of your paper.



CONTENT

22. Presenting the Symbol For Nine

RESOURCE MATERIAL

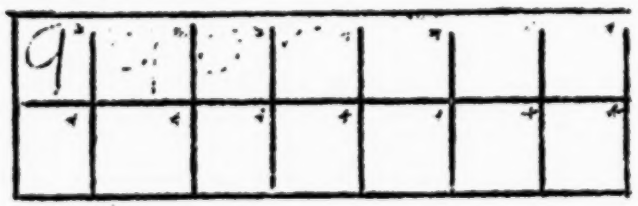
SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

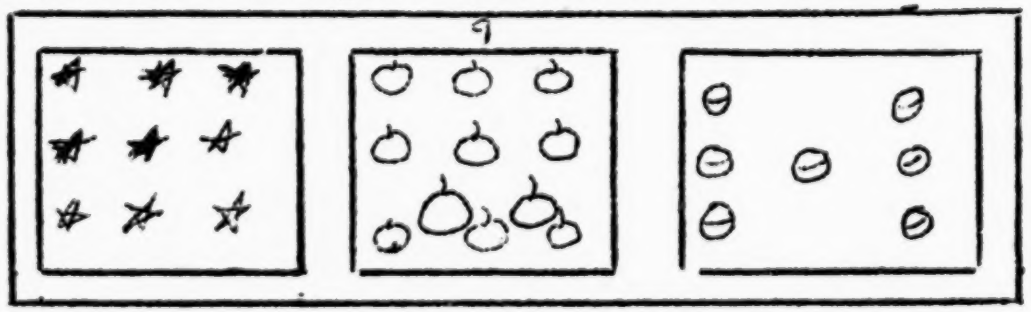
Plan practice lessons in the formation of the numeral 9. Have the children work at the chalkboard before they write on paper. Ask each child to draw a set of 9 and label each set with its numeral. Give the children this descriptive phrase to help them form a mental picture of the symbol they are writing.

Make an oval and then a line,
This is the numeral known as 9.

When the children are ready for writing on paper be sure the first few pages indicates where the child is to start. Tell them to place their pencils on the star and pull around and back and then straight down. Explain that the star and the broken line will make it easier for them to write the numeral nine in the second box. Remind them to place their pencils on the dot each time.



On the flannel board place a set-card for 7, for 8 and a set-card for 9. Put the numeral 9 at the top of the board. Have a child choose a set which corresponds to the numeral. Have a child identify the number of the set. Continue the activity. Use three sets with different numbers, and place a numeral at the top of the board which corresponds with one of the sets.



CONTENT	RESOURCE MATERIAL
23. Teaching the Concept of Ten.	

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

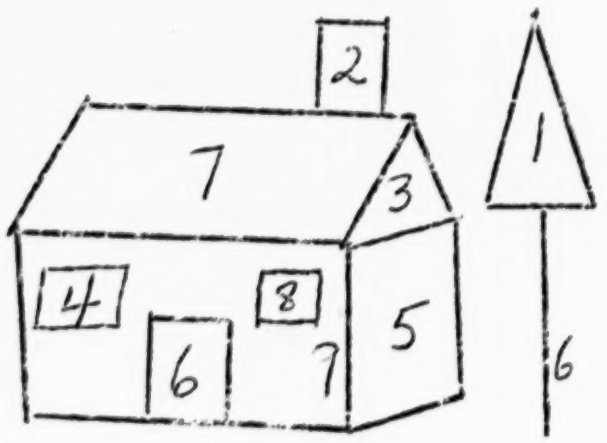
LEVEL I

At this point ten is treated in the developmental sequence of the program as the number which comes after nine in the basic counting sequences. This meaning of the number ten is the only one emphasized at this time. the place-value description of the number ten will come much later in this program.

Show me these things in our classroom: 10 beads on our abacus, 10 pieces of art paper, 10 pencils, 10 crayons, etc. Joe, tap your pencil on the table as many times as a clock will strick at ten o'clock. Nancy, clap 10 times, Jean walk 10 steps, draw 10 tops on the chalkboard, etc.

It is good to check the progress of the children before the symbol for ten is introduced. This is an easy way to make that check. Provide each child in the class with a strip of paper on which the numerals 1 through 9 have been printed in random fashion. To each child distribute strips of paper which have been marked off in 9 boxes. Direct the children to cut the numeral 1 from their strip of numerals and place it in the first box. Have them continue until all the numerals are arranged in counting order.

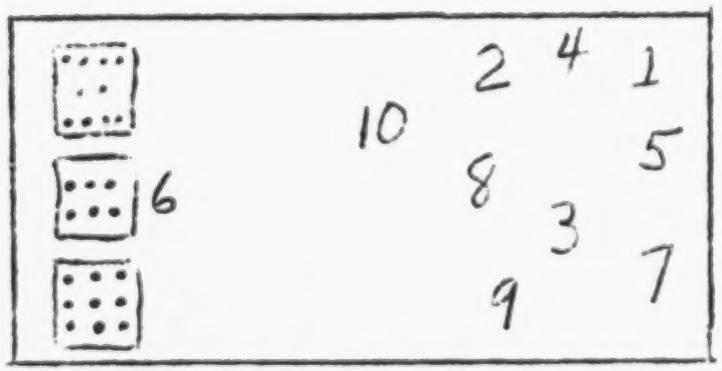
Give each child a paper on which there is a house and tree. Each part of the house and tree are numbered for coloring. On the chalkboard write the directions for coloring the house and tree. In the direction use sets instead of numerals.



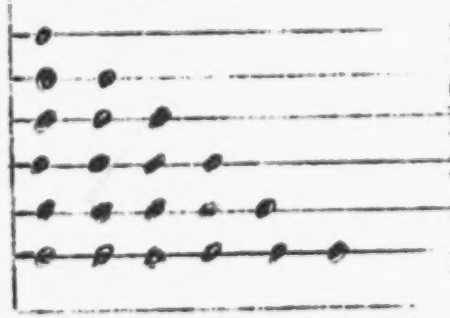
Directions

- green
- brown
- blue
- red
- black
- orange
- yellow
- purple
- black

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
24. Presenting the Symbol for Ten.		LEVEL I Watch me as I write ~~ten on~~ the chalkboard. Write a big 10 on the chalkboard saying as you do, First I write a 1. Then beside the one I swing down and around and close up tight. Now as I write another big 10, say it with me. First a 1 and then down and around and close up tight I make the zero. Be sure to have the children practice writing their tens on the board before they write on paper. Watch for reversal of the numerals. Have those who have difficulty trace the emery-paper kinesthetic copy of the numeral ten. The children should draw a set of ten objects and label it with the numeral 10. Place 3 or 4 pictures of sets on the flannel board. Have numerals ranging from 1 through 10 on the right hand side of the board. Call the children to the board and have them place the correct numeral by each set.



CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
C. NUMERAL RELATIONSHIPS		
1. Using the Abacus		The abacus has been found to be the basic tool the child uses in understanding numbers. A concrete concept of numbers is taught with the use of the abacus. The child can readily see the difference in spatial relationships. Each row is a different color to help the child locate the number row. It is very important that each child have an abacus of his own so that when he is ready to use it, it is available. As the child counts the beads he pushes them over. For 1, he pushes one bead over on the row at the top. Some children need to begin with a simplified abacus. Each row having one more bead.



This is especially good for children with spatial difficulty.

Another advantage of the abacus is that the children learn to see the threeness of a number. Ask a child to make each row say three, begin with row three. He begins with row 3 on the left, then makes all the other rows match it by pushing the extra beads to the right on each of the following rows.

Then he may do the same for the other numbers.

When the teacher feels the child has a good understanding of numbers 1 to 6 she is ready to teach sets. She asks the child to pursh over "4". Then she shows him all the ways he can make 4, such as pushing 1 and then pushing over 3 (in the same row) and so on.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
		A standard abacus with one row (10 beads) can be introduced to all the children at this point. Here the child is helped to see numbers in a linear position. Ask the children to push over 1 bead and 2 beads or 2 beads and 2 more beads. It is hoped that the child will see 4 has 2 and 2 and will push over the beads in a group. Use of this abacus will thus be another means of helping the child to learn sets. All of the work with the abacus should be done orally with level one.
2. Teaching Sequence	For the teacher - the set of large numbers from 1 to 10 written on cards which can be set up in the chalk tray. For each child - a card holder and cards for the "Everybody Show Game" (See page)	The teacher may say: 1. Today I have 10 cards. On each is a number. Let us put the card in order in the chalk tray. Numeral 1 is first. Numeral 2 is next. What numeral is next? Continue until all the cards are placed in order. 2. Children close your eyes. Remove a card. Now open your eyes. What number is missing? Children close your eyes again. Reverse two cards. Open your eyes. Which numerals are not in their right place? Who can put them back where they belong? 3. Close your eyes again. Put three cards out of their places, such as 4, 5, 6 changed to 6, 4, 5. Open your eyes. Which numerals are not in their right places? Who can put them where they belong? 4. I am thinking of a numeral. It is the numeral that comes after 7. Look at the cards in the chalk tray and find the numeral. (Be sure the numerals are in the correct order.) Lay out your "Everybody Show Game" cards on your desk. Show me your answer in your card holder. Use this step to practice all the numerals from 1 - 10. 5. On the chalkboard are some numbers. After each numeral is a line. On each line belongs the number that comes after each of the numerals on the chalkboard. On your paper write the numerals that belongs on each line. Write your answer in four rows like you see.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

7 ____		9 ____	
3 ____		6 ____	
1 ____		4 ____	
9 ____		5 ____	
2 ____		8 ____	
2 ____		8 ____	
1 ____		5 ____	
9 ____		4 ____	
3 ____		6 ____	
7 ____		9 ____	

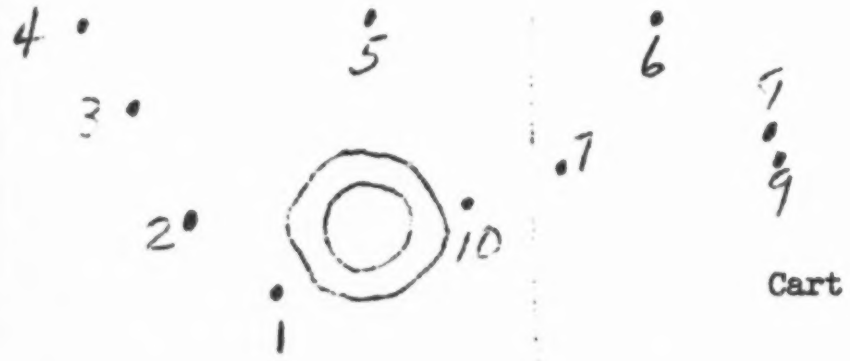
This lesson in different forms will have to be repeated often before the children can do this without looking at a number line.

A dot-to-dot book, to use as seatwork papers. Be sure the numbers are from 1 - 10.

Place dot picture on the board. Ask child to come to the board and find numeral one, then numeral two. Have him trace over the dotted line with his chalk, moving from 1 to 2 then to 3. Let another child go on from this point and draw the line from 3 to 4, another child from 4 to 5, etc.

Use the above plan for drawing the sequential lines for each of the dotted pictures you place on the board.

Dotted pictures:

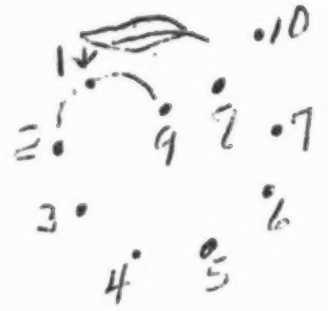


Cart

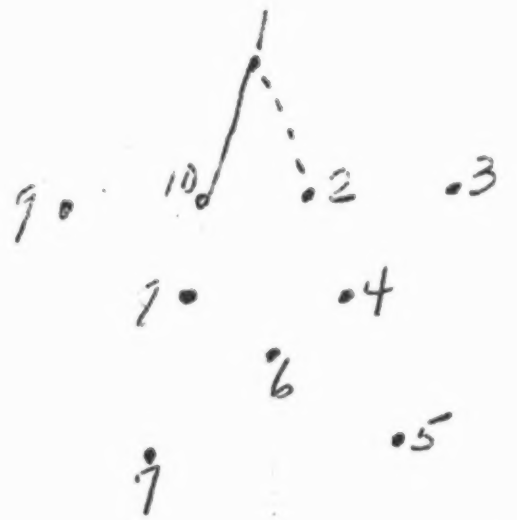
CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND MATERIALS



Apple



Star

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
	For the teacher - a set of large numbers from 1 to 10. For each pupil - A card holder and cards for the "Everybody Show Game"	I am thinking of the numeral that comes before 6. Look at the cards in the chalk tray and find the numeral 6. Then find the numeral that comes before 6. Lay your "Everybody Show" cards on your desk. Show me your answer in your card holder. Use this pattern to practice all the numerals from 2 to 10. This should be continued for several days until all can participate with some degree of accuracy. On the chalkboard are some numerals. Before each numeral is a line. On each line belongs the numerals that comes before each of the numerals on the chalkboard. On your paper write the numerals that belongs on each line. Write your answers in four rows like the rows you see on the chalkboard. ____ 8 ____ 7 ____ 3 ____ 9 ____ 3 ____ 5 ____ 2 ____ 6 ____ 2 ____ 6 ____ 10 ____ 5 ____ 10 ____ 9 ____ 4 ____ 7 ____ 4 ____ 10 ____ 8 ____ 10
Comparative Terms	The teacher should try to find pictures of a boy and girl, mother and father, elephant, seal, giraffe, squirrel, horse, colt, cow and a calf. There is an excellent kit by Leila Armstrong - Follett Pub. Co., Los Angeles This kit is called Come and Count and has flannel board set with it.	Place on the flannel board the boy and the father. Discuss the fact that the father is big and the boy is little. Do the same with the girl and mother. Then show animals such as lion and a mouse, a cow and calf. Let the children arrange the other animals, discussing their comparative sizes, and using the term of comparison, big, little. Have the children find many objects about the classroom and talk about them in terms of big and little. Have the children think of big and little things to be seen out of doors, and in the children's homes. Activities: The teacher and children may play a game of following directions: Put the big book on the big table.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

Put the little piece of chalk on the little table.
Bring me a little pair of scissors.
Put a big pencil and a little pencil on the reading table.

Directions for drawing may be given:
Make a big house for a family.
Make a little house for their dog.
Make a big tree to give shade for play.
Make a little apple tree.
Put a big bird on a nest feeding a little bird.
Make a big doll and a little doll for the girl.
Make a big airplane and a little airplane for the boy.

Big and little are common words which are familiar to the children. An understanding of other words used in making comparisons may be built upon a knowledge of these two words. For instance, at the start of a class discussion, the children may be asked to suggest other words which could be used instead of big to describe some object such as a ball or teddy bear. This could lead to further study and use of words suggested, such as large, small, larger and smaller.

The teacher guides the children to understand that they should use the word forms larger and smaller when they are comparing two things of different sizes. She should prepare to show the children several illustrations, books, sheets of paper, boxes, blocks, toys, cups, containers of various kinds such as milk cartons, fruit jars, pieces of chalk, and pencils are among the things which would be suitable. The children may locate other objects as they look about the room. After the children have made at least a dozen comparisons in which they use the words larger and smaller, write the words on the chalkboard.

Have the children point to the correct word as they compare the objects until all the children know the words by sight. It may be necessary to have some of the children trace the words several times before they can read them. After this has been accomplished they may use work sheets to develop their understanding further.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

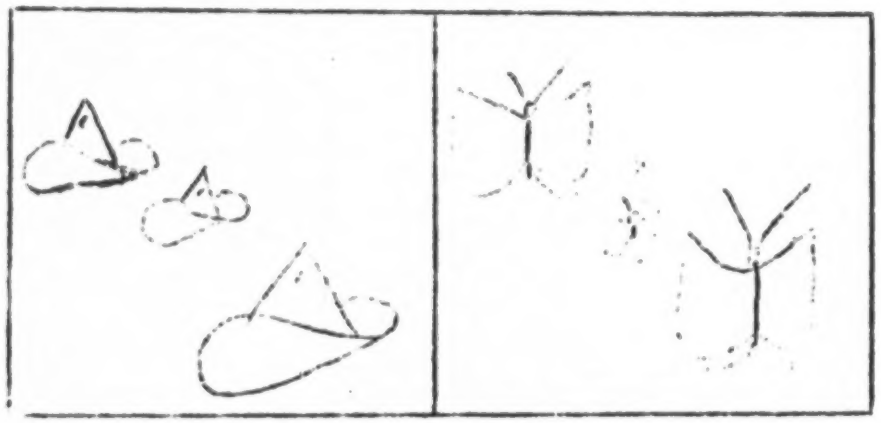
LEVEL I

Two objects of different sizes, such as a big chair and a little teddy bear, may be pictured. The children are asked to draw a smaller chair and a larger teddy bear.

When the superlative forms of the words are introduced, the pupils should note that when they are comparing three sticks of different sizes, for example, they use largest, and smallest or longest and shortest; when they are comparing only two sticks they use larger and smaller or longer or shorter. These concepts should be presented many times in discussion with objects the children can handle and compare. Correct oral use of the words should be emphasized. Pictured illustration may be used to develop additional understanding.

One good way to develop understanding is to fill a set of shelves with toys of varying sizes and, to give practice in using the words, have the children play store. The children take turns being clerks and customers. A customer would ask for the largest doll, or the longest cane, and the clerk would produce the requested article. Pictures of toys could be substituted for the real toys if necessary. The shelves could be drawn in outline on a large sheet of paper fastened to the bulletin board, and the pictured toys held in place with pins.

Seatwork:



Directions: Copy the pictures. Then on your paper put

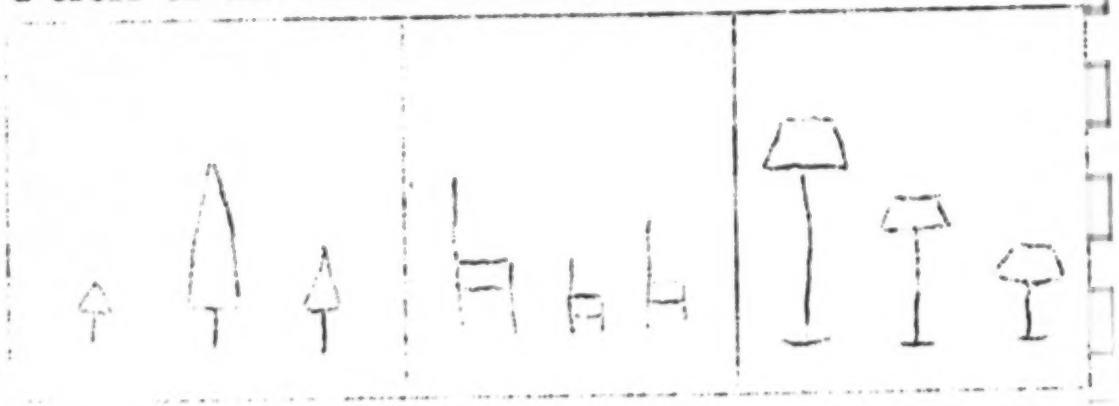
CONTENT

RESOURCE MATERIAL

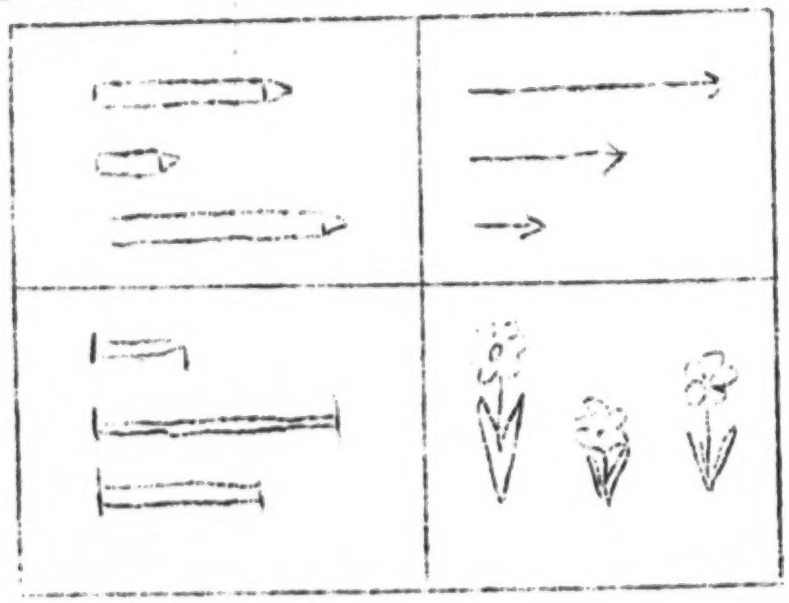
SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

a cross on the tallest and a ring around the shortest.



Directions: Copy the pictures. Then on your paper put an X on the shortest and put a ring ◯ around the longest in each group.



Directions: Copy the pictures. Then on your paper put a cross on the largest and draw a ring around the smallest in each group.

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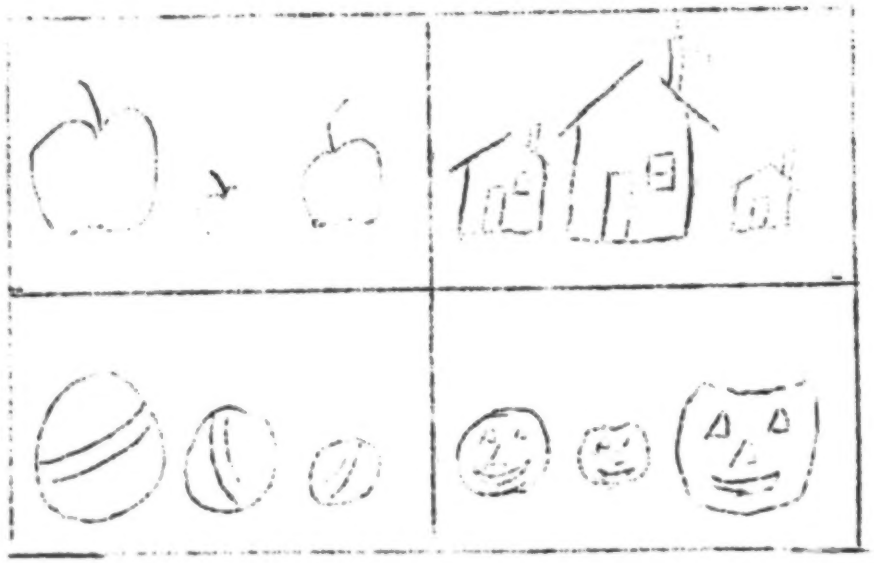
RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

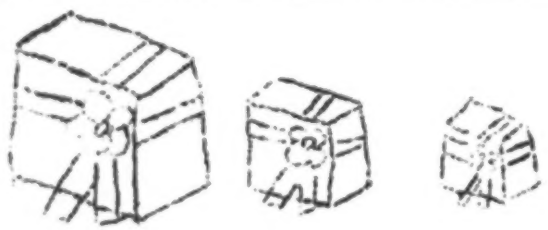
LEVEL I



Directions: Copy the pictures. Then on your paper put an X on the smallest and a ring around the largest in each group.

Color the largest
Put X on the smallest

Put X on the largest
Ring the smallest



Color the largest
Put X on the smallest

Color the largest
Ring the smallest

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
D. CARDINAL, ORDINAL AND WORD NUMBER RELATIONSHIPS		**LEVEL I**
	If possible have some child bring to school 2 toy soldiers; another child 2 toy cars; another 2 toy airplanes; and another child 2 toy animals. Also cut from magazines pictures of 2 objects in a row.	To teach the ordinal numbers first and second we are trying to help the child learn that one and two tell how many objects there are, but the words first and second tell which objects. Stand several children in a single file facing the front of the room. Ask, "Who is first?" Some of the children may know the answer. If not, indicate the one who is first in line. Move another child up to first place and ask the same question. Have each child turn around in place and face the back of the line. Ask, "Who is first in line, now?" Touch the child who is the first one in line to be sure the group understands the meaning of the word. Write "first" on chalkboard. Use objects in the same manner to continue teaching the meaning of the term first. Place in rows the objexts the children brought, ask the child to touch the first one and have him say, "This is the first _____." After each child is confident of the pronunciation of the word first and of its correct use, he should make a complete sentence and say, "This is the first car in the row." Now have two children stand in a row facing the front of the room. Let us count the children as I point to each child. One, two. "We say one, two when we want to know how many children there are." Now have the two children face the side of the room. Ask them to walk three steps forward and stop. We want to find a certain child in the row instead of counting the children. We know the leader of the row is always first. Write first on the chalkboard. Who is first in this row of children? Have a child answer in a sentence. The child next to the leader is second. Write second on the chalk board. Who is second in the row of children.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
	Several cards with words "first" and "second"	**LEVEL I** Have the children, "about face" so that they are facing the opposite direction. Ask them to walk three steps forward and stop. Now, who is the leader? Who is first? Point to the word first on the chalkboard. Who is second? Point to the word second on the chalkboard. If the children have brought toy soldiers, cars, airplanes and animals repeat the same steps with the toys. Do the same with any pictures showing first and second. Then pass out the cards and have the children place the correct card beside the toys or objects. Also a flannel board may be used to show different objects in rows of two. Have the children remove the object - first or second - as he is asked to do. He should say, "This is the first apple." or whatever the object is. Parallel the situations in the lesson with chalkboard drawings. Have the children draw a line from the word to the correct object.
		 first Second first Second first Second The concept of last should be presented after the teaching of first and second. Use the same procedure as in teaching first and second. Be sure not to use the same number in the rows so that a certain number will not be connected with the word last.
E. READING AND WRITING NUMERALS	A set of word cards from one to ten for each child. The cards and card holders for the Everybody Show Game	"Everybody Show" Game In a class of eighteen children any practice exercise that permits only one child or a limited number of children to respond limits the benefits to those children who make responses. The "Everybody Show Game" is a

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

How to Make the Cards:
Every child should be given ten cards 3"x5". On each card the child or the teacher should write with a dark crayon or felt pen one of the ten numerals from 0 to 9. The numerals should be placed on the card allowing from one-half inch to one inch of space at the bottom of the card.

The numbers should be neat, legible, and almost as big as the card.

The ten cards are adequate for all practice on number facts and for matching the number names one to ten with printed number symbols.

How to Make the Card Holders:
Make a card holder for each child. In it he will place the cards which will show the answer to the number grouping that you will write on the chalkboard, or to some stated question that has a number for the answer.

Take a 6"x9" sheet of red construction paper for each child. Lay it with the 9" edges at the top and bottom. Fold up one-half inch on the bottom edge to make a pocket. Staple the ends so that the folded pocket is held firmly in place.

procedure that will enable the teacher to see at a glance the response from every child to every question asked.

Thus, on ten practice items, the "Everybody Show Game" enables the teacher to see one hundred eighty responses.

When only one child responds to each item only ten individual responses are given.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
1. Teaching Word Recognition of the Numeral Names One and Two; to Test Word Recognition by matching the Quantity with the Numeral Name.		**LEVEL I** Place on the chalkboard ledge the kinesthetic number cards 1 and 2. Today we are going to learn to read the number names for the numbers 1 and 2. Hold up the word card one. This is the number name for this number. Hold up the kinesthetic card 1 and hold it beside the word one. Say the word. Who can bring me this many books, crayons, pencils, etc. Hold up the word card one. Who can clap this many times? Repeat step 1 for the number name two. Print the two new number names on the board. Select the children who have difficulty with word recognition to trace over the word with chalk. A study has shown that non-readers increased in skill in word recognition when asked to trace over words they were to learn. Tracing helped to fix the configuration of the word. In cases where these non-readers traced the word until they could write it correctly from memory, the retention was highest. Tell the children to keep saying the word to themselves each time they trace it. Have the children place the cards for the "Everybody Show Game" on their desks. As you hold up a word card have the children show the matching numeral in the card holders. Have the children practice writing the words one and two on the chalkboard until they can do it correctly. Then have the children draw one object and write the numeral 1 and the word one. Then have the children draw two objects and write the numeral 2 and the word two.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
2. To teach word Recognition of the Numeral Names three and four; to Test Word Recognition by Matching the Quantity with the Numeral Name.		Place on the chalkboard ledge the kinesthetic numeral cards 1 to 4. Today we are going to learn to read the numerals 3 and 4. Hold up the card three. This is the numeral names for this numeral. Hold up the kinesthetic eard 3 and hold it beside the word three. Say the word. Who can bring me this many pieces of chalk? Have the children bow this many times; draw this many balloons; etc. Print the new number names on the chalkboard. Select the children who have difficulty with word recognition to trace over the word. Tell the children to say the word to themselves each time they trace it. Have all the children practice writing the words on the chalkboard before they write on paper. Have the children place the cards for the "Everybody Show Game" on their desks. As you hold up the word cards the children will show the numeral symbol in their card holders.
3. To Teach Word Recognition of the Numeral Names for Five, Six, Seven, Eight, Nine and Ten.		Repeat the Procedure in the above one to four for the numeral names for five, six, seven, eight, nine and ten.

DEVELOPING THE BASIC ARITHMETIC PROCESSES

Section III

Level I

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
III. DEVELOPING THE BASIC ARITHMETIC PROCESSES		
A. ADDITION		
1. Set Union (Readiness for Addition)		In a well planned program one phase of study leads into the next through a series of developmental activities which are closely related or tied together. Accordingly, the ideas presented in the beginning steps in primary numbers form a foundation upon which an understanding of the process of addition may be built. The child must have an understanding of the numbers through ten. He should understand number sequence, and he should have the ability to count rationally, to recognize and write the number symbols, to identify the number groups, and to reproduce specific quantities. A brief period of review in these areas may be desirable. The children must also understand the meaning and use of certain terms related to the teaching of addition. Since the teacher will be using the word set to designate the two numerals in an addition problem, it is essential that the class clearly understand the meaning of set. Likewise, the meaning of the phrases "in all" must be developed. The children should study varied arrangements of subject sets until they have mastered the concept of two sets making a total. They must be able to think of two or more objects as a unified whole, to think in terms of sets. After the class has reviewed the background material essential to the understanding of addition, the class may have to be grouped into those pupils that are ready for simple addition and those who need more work in the beginning essentials. Those that are ready will now develop the idea of addition through classroom activities with manipulative

CONTENT

RESOURCE MATERIAL

Flannel Board
Felt numerals 1 and 2
1+1 Numeral card, fixed to adhere to flannel board
Felt cutouts

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

materials. Not until the class has become familiar with the ideas through objective presentation are the abstract forms introduced.

Since the children must be familiar with subsets composing the numbers to 10 the first step is to introduce sets and set union. They will handle these combinations by using concrete materials and the flannel board.

However in the immediate preparation for written work the teacher should limit the material to the use of smaller numbers. The sums of 2, 3 and 4 may be studied. Later, the sums of 5 are introduced, and then the sums of 6, 7, 8, 9 and 10. The children in the first level of the E.M.R. classes are not expected to gain facility with sums above 10. Abstract problems are not presented, but pictures or words are used to suggest concrete objects.

Place a set of one object on the flannel board. Have a child select the appropriate numeral and put it over the set. Ask someone to build the set which contains one object and one more. The one more object should be a different color. Direct a child to place the related numeral over this set of two. Present a different numeral for the number two. Place a card with the number 1+1 under the set of two.

Explain that this label helps us think about the set which contains one and one more. Tell the children they should say 1 add 1 when they read this numeral.

Place the numerals 1 and 2 and the numeral card 1+1 on one side of the flannel board. Present a set of two. Have the children select a numeral or the numeral card to label the set. Ask if someone else can find another label for the set of two and when he does, immediately relate the numeral 2 and the numeral card 1+1 with the set of two. Continue the activity; alternate sets of one and two.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

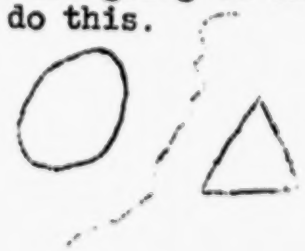
Flannel board
Felt Cut Out
Yarn
Felt Numerals 1 and 2
Add sign
Equal sign

On the flannel board arrange two sets, each containing one object. Have the children determine the number of each set. Now bring the set on the right close to the set on the left. Say, "A set of one has been joined to another set of one to make a new set of two."

Discuss with the children the new set that has been formed. Help them determine the number of the new set. The number of the union of the two sets. Say, "A set of one and a set of one can be put together to make a set of two." Explain to the children that another way to tell the story, or describe what happened, is to use only the numbers of the set and say, "One add one is the same number as two."

Lead the children to visualize the original sets as sub sets of the new set. Say, "A set of two contains a set of one and a set of one." To help the children visualize the two sets that have been joined to make the new set, and which are contained in the new set, a piece of yarn may be placed between them.

Explain to the children that there is a special way to write about what they see on the flannel board. Tell them that it would be possible to write words in a sentence to describe the idea that they see on the flannel board, but you are going to show them a quicker and easier way to do this.



1 + 1 = 2

Write the words, "One add one equals two." Read the sentence to the class. They will be familiar with the word "sentence" from their reading experiences.

Now place the equation 1+1=2 under the set on the flannel

CONTENT

RESOURCE MATERIAL

Coloring books are excellent sources of pictures for teachers that cannot draw. Glue flannelette on the back before cutting them out if they are to be used on the flannel board. This will keep them from tearing and make them them stick.

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

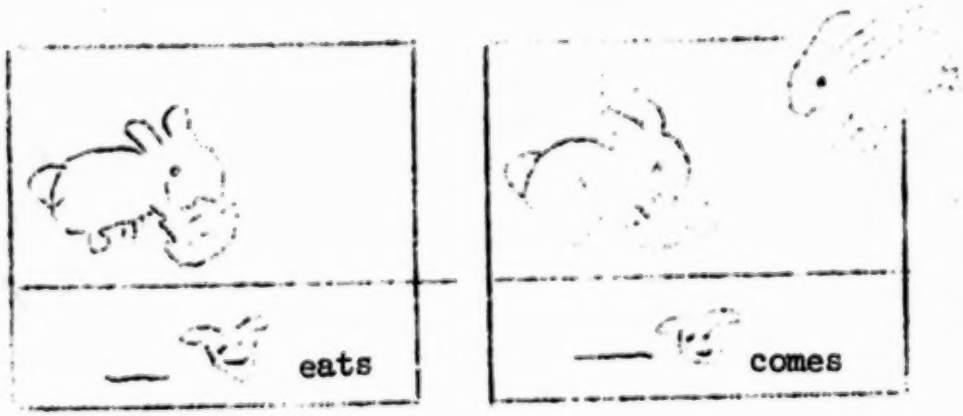
LEVEL I

board. Tell the children that this is also a special kind of a sentence called an, "equation" The word equation will be learned through use by the teacher. The children will not use the word for some time.

Use dramatization to demonstrate problems:
James may place 1 rabbit on the flannel board.
Bruce may place one rabbit beside it.
How many rabbits are there in all?

Let us make a little play to show this story. Who will be the first bunny? Who will be the second bunny who comes into the picture.

Then on a paper give the same story.



1 and 1 are _____

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

When a child is beginning to add it is very important that he understands that each number in the series has a special place and meaning. This may be accomplished by using objects placed in rows to show that a number is one more than the number that it precedes and that it is one less than the number after it.

The give-and-take dialogue between the teacher and the child is important for retention and eventual comprehension. The teacher may use a procedure similar to the following using buttons, beans, blocks or cards to illustrate the problem: In the sample dialogue T represents the Teacher and C the child.

T: Two are more than one, Place one button beside another button. Take away a button.

C: Two are more than one.

Repeat this procedure over and over using many kinds of objects. Use sticks to demonstrate.

T: I will give you one stick. How many sticks do you have?

C: One stick.

T: Here is one more stick. Put this stick with your other stick. Now I will pick up one stick. I now have one stick in my hand. You have two sticks. Do you have more sticks than I have?

C: Yes, I have more.

T: How many sticks do you have?

C: Two sticks.

T: Now, you tell me the two sticks are more than one stick.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
		Repeat this type of drill over and over, changing the objects so that the child will not associate the more than with any one object. At the same time, the teacher should try to get the child to give a complete sentence as a response to her question.
		When a child is ready for another number in the series, the same procedure is carried out. The concept of "less should not be taught parallel with "more than" at this time, as it would confuse the child. Only after the concept of the numbers 1, 2, 3, 4 and 5 have been established should the idea of "less than" be presented.
3. Addition Combinations	A good source of number stories for the children to illustrate is: Number Stories, Book 1 By J. W. Studebaker, W. C. Findley & F. B. Knight; Scott Foresman Co. Curriculum Foundation Program, Chicago	Counters such as lima beans, straws, or squares cut from heavy paper are used by each child in demonstrating problems at his seat. The teacher gives the problem orally as she walks among the pupils to see that the proper grouping are shown. The story might be about Mary and Jane. Mary had one cookie in her lunch. The children show this with one counter. They also place the numeral one beside the counter using the numerals from their "Everybody Show", game. Jane had two cookies in her lunch, shown by two counters and numeral two. How many cookies did they have in all? The numeral is placed under the counters. After the solution is shown with counters on the children's desk, the teacher, referring to the problem may ask: How many cookies did Mary have? How many cookies did Jane have? How many cookies are there in all? Then, she may go on, saying, "Place your left hand below the counter which shows Mary's one cookie. Place your left hand below the counter which shows Mary's one cookie. Place your right hand below the counters that show Jane's two cookies. One cooky and two cookies are how many cookies? Then the children may show the problem on their abacus pushing over one bead for Mary's cooky and two beads

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL I
		for Jane's cookies and then telling how many beads they have pushed over.
		Chalkboard or flannel board illustrations may accompany the use of counters at the desks. The teacher may draw two cups and one cup on the board or place them on the flannel board; the children then illustrate the sets with their counters. The numbers should be placed by each set and also below the pictures on the board. The teacher then asks, "How many cups are there in all?"
		 2 cups and 1 cup are 3 cups
		When this procedure is well established it can be varied by having a child first arrange his counters to illustrate a problem, and then have him come to the chalkboard and make crosses on the board to show how his counters are arranged. The numbers should be written below each set of crosses. The teacher should check to be sure the crosses and the counters on the desk tell the same problem. Most of the children will have to count the sets in order to find out how many there are in all, but exercise sheets and much practice will serve to strengthen these concepts.
	Pictures from Magazines & worn out books	In the next step action pictures may be used. For example, the picture might show two girls at a table and another girl coming to join them. The class notices that there are two girls in one set and one girl in another. After discussing the picture a child tells how many girls there are in all. The teacher says, "Two girls and one girl are three girls," but if the children tend to shorten this to 2 and 1 are 3, this answer should be aceepted. In fact, we want all children to acquire the generalization that 2 and 1 of anything are 3.
		When the class in general understands the addition of two groups arranged horizontally, the vertical form

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

may be presented. Shelves used during introductory lessons will help the children to see the vertical order of the items. (Two boxes, one on top of the other with the open ends toward the class, will make the shelves.) A girl may place two dolls on one shelf and one doll on the shelf below it. The question is asked, "How many dolls are there in all?" The number statement may be written on the board as follows:

2 dolls
1 dolls
3 dolls

Toys, block or books are a few of the things that can be used in other examples.

Following the activities with shelves and real objects, the teacher may use chalkboard or flannel board illustrations. If the chalkboard is used a simple outline of two shelves may be drawn to help the class see the two sets again in vertical arrangement.

On the flannel board yarn can be used to outline two shelves. Sketching or placing a picture of two cans on the lower shelf, the teacher may say, "These are shelves in a grocery store. How many cans are on the top shefl? How many cans are on the bottom shelf? How many cans are there in all? As the children respond, the problem is written at the side of the picture or illustrated by felt numerals on the flannel board through suggesting that the storekeeper sold some cans of fruit or vegetables and placed new ones on the shelves, various combinations may be illustrated. Books and dishes or other items which are often placed on shelves may be used.

After the children have become accustomed to thinking of problems in the vertical arrangement, the outline of the shelves may be omitted. Both horizontal and the vertical arrangements of known addition facts may be combined on work sheets, thus providing review and practice to maintain learning.

As the class develops reading abilities, the children

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

will recognize more words and will become more independent in reading and number statement. The words should be, insofar as possible, those with which the children are already familiar. However, an occassional new word introduced in the arithmetic period is not too distracting, particularly if it can be associated with a picture. The teacher should be ready to help with unfamiliar words

3 dogs
1 dog
dogs

3 dogs and 1 dog are _____ dogs

The introduction of other addition facts should follow a developmental pattern similar to that outline for presenting the addition facts of 2, 3, and 4. Thus the sets of five would first be dramatized, then shown in concrete materials. Work sheet activities involving sums of five and including a review of other facts would follow. Sums of six would be presented when the majority of the group has acquired a satisfactory degree of skills with smaller sums and on to ten. Maintenance of understanding and skills should be assured by reviewing ideas at spaced intervals throughout the number program.

CONTENT

B. Subtraction

1. Set Separation

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

Understanding the process of subtraction in solving problems is more difficult than simple addition, especially for E.M.R. children. In addition problems the only concept to be presented is the combining of two sets into a total. When column addition is introduced a third group is added in a repetition of the same process. The order in which the sets are combined makes no difference in the final amount. This is not true in subtraction. The relationship between the two groups in a subtraction problem is very important. The child must distinguish between the number which he should subtract and the number he should subtract from. He can take 1 from 2, but he cannot take 2 from 1 without introducing a minus quantity.

The question to be answered in subtraction is not always the same. It may ask how many are left, how many are gone, which set is larger, or how many more are needed. The types of problems which are solved through the process of subtraction may be classified as follow:

Finding how many are left.
Mary had 5 cookies.
She ate 2 cookies.
How many are left?

Finding how many were taken away
Mary had 5 cookies.
She had 3 left.
How many did she eat?

Finding how many more are in one group (set), than another.
Mary has 3 cookies.
Jane has 2 cookies.
Which one has more cookies?

Finding how many fewer are in one group (set)

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

(a) Readiness for subtraction.

than in another.

Mary has 3 cookies.
Jane has 2 cookies.
Which girl has the fewer cookies?
How many fewer does she have?

Finding how many more are needed.

Mary has 3 cents.
She wants a toy that costs 5 cents.
How many more cents does she need?

In the first level program most of the problems will deal with, how many are left?

Subtraction problems are more difficult for the teacher and pupils to illustrate. If four blocks are shown and then two are taken away, the child can see how many are left, but he must visualize the original group of four to see the complete number facts represented by 4 blocks take away 2 blocks are 2 blocks. With pictorial material the crossing out or covering up of blocks to show that they were taken away is not so clearly understood as the counting together of 2 blocks and 2 blocks to make 4 blocks in an addition problem. There fore the teacher will need to plan many experiences in subtraction if the children are to achieve a satisfactory degree of understanding.

The readiness program in subtraction includes the same ideas outline in the introduction to addition. Both processes require a well-developed understanding of the numbers through ten. Special terms used in the process must be given careful consideration. Significant words which have been introduced earlier in the number program should

CONTENT

(b) Using Concrete Materials to Illustrate Problems.

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

be reviewed as they are needed. For example the meaning of set was presented in the readiness program for addition, but it is important in subtraction too. Other terms which the children should clearly understand are: as many as, more, more than, less, less than, the same as, fewer, and fewer than. The words subtract and subtraction should be used orally here so that they will be meaningful when met in reading situation later. In planning for the introduction of subtraction, the meaning of the expression take away must be clarified. Introduce the minus sign as take away. This is a much easier understood term.

The first nine subtraction facts introduced and developed are:

2	3	4	5	6	7	8	9	10
-1	-1	-1	-1	-1	-1	-1	-1	-1

These facts are introduced one at a time and exercises are provided which will aid the children in "seeing" and "saying" that subtracting 1 from a number is the same as saying the number that comes just before it in the counting series.

The teacher may ask Mary and Jane to come to the front of the room. She gives Mary 2 counters and says, "Here are 2 counters, Mary. Give one to Jane. How many do you have left?" After the teacher states the problem the children act it out.

Then she asks the class leading questions such as these: How many counters did Mary Have? How many did she give to Jane? 3 counters take away 1 counter leaves how many? Does Mary have 2 counters left? Individual experiences should be provided by having each child use counters, chalk, blocks, books, pencils, crayons or any other materials that are available.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

Incidental situations in the classroom should not be overlooked. For example, the teacher might say, "We have three goldfish in our bowl. Tonight Bob is going to take one home. How many goldfish will there be in our bowl then?" Or, there are five chairs at the reading table. Miss White wants to borrow one for a class play. How many shall we have left? Or, I have seven pencils in this box. I will give one to John. How many do I have left?

CONTENT

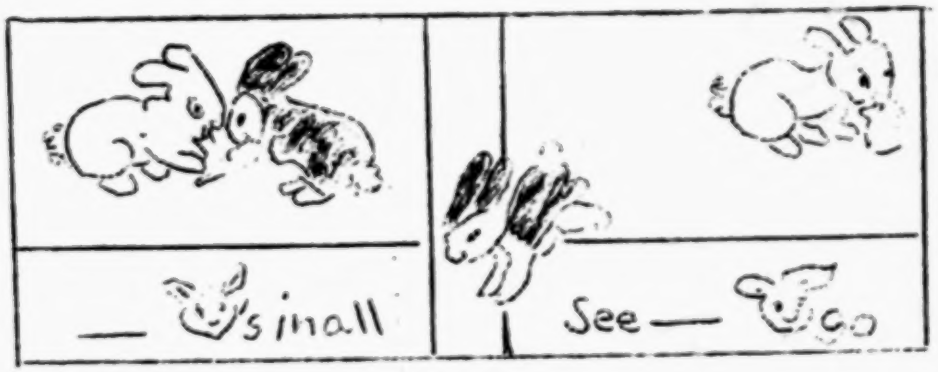
c. Using Action Pictures to Illustrate Problem.

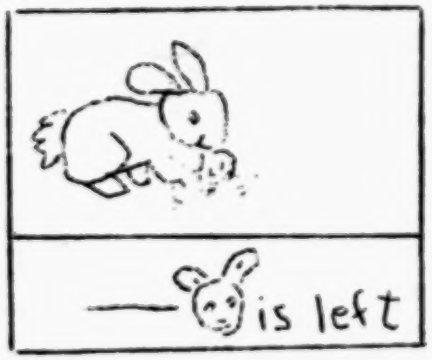
RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

In the next step action pictures are used to illustrate the problems. One of the clearest ways to show the action is to have a series of three pictures. The first shows the total set, the second shows some of the group going away, the third shows the ones left.





In making illustrations, the more clearly the children can distinguish the items take away from those that are left, the more definite will be the impression. Using color is one of the easiest ways to help children distinguish between objects or groups.

CONTENT

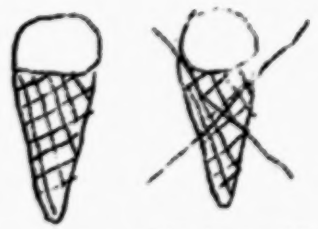
d. Introducing Vertical Order in Subtraction.

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

After the children have acquired an understanding of take-away problems through many experiences with concrete materials and through action pictures, the vertical form may be presented. The teacher may draw an illustration on the board and ask a child to work the problem by crossing out the object taken away.



2 cones take away
1 cone.

_____cone is left.

Then she may ask how the number statement should be written. Since the children are familiar with the vertical form in addition, they may suggest writing it in that form. If not, the teacher explains that one number can be written below the other; that the top number tells how many there were at first, that the next number tells how many were taken away, and that the number below the line tells how many were left.

Because the vertical form has been used in addition, the children should grasp the idea after many experiences.

CONTENT

c. Subtracting 1 from a number and Subtracting all but 1 are related.

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

Use concrete material to illustrate these related facts. Help the children to see that if he knows 1 from 6 are 5, he also knows that 5 from 6 is 1. Draw pictures and semi-concrete representations of the facts. Not al children will grasp this the first time it is taught but with much repetition they will lear these facts. As you draw pictures, cross out 1. Then cross out all but 1. Talk about what happened. Continually ask such questions as: "If you know that 1 from 4 is 3, what other subtraction fact do you know?"

Get small groups of objects of different sizes or color and tell and write two subtraction facts about each group. Actually tak away 1 and all but 1 as subtraction facts are stated and written.

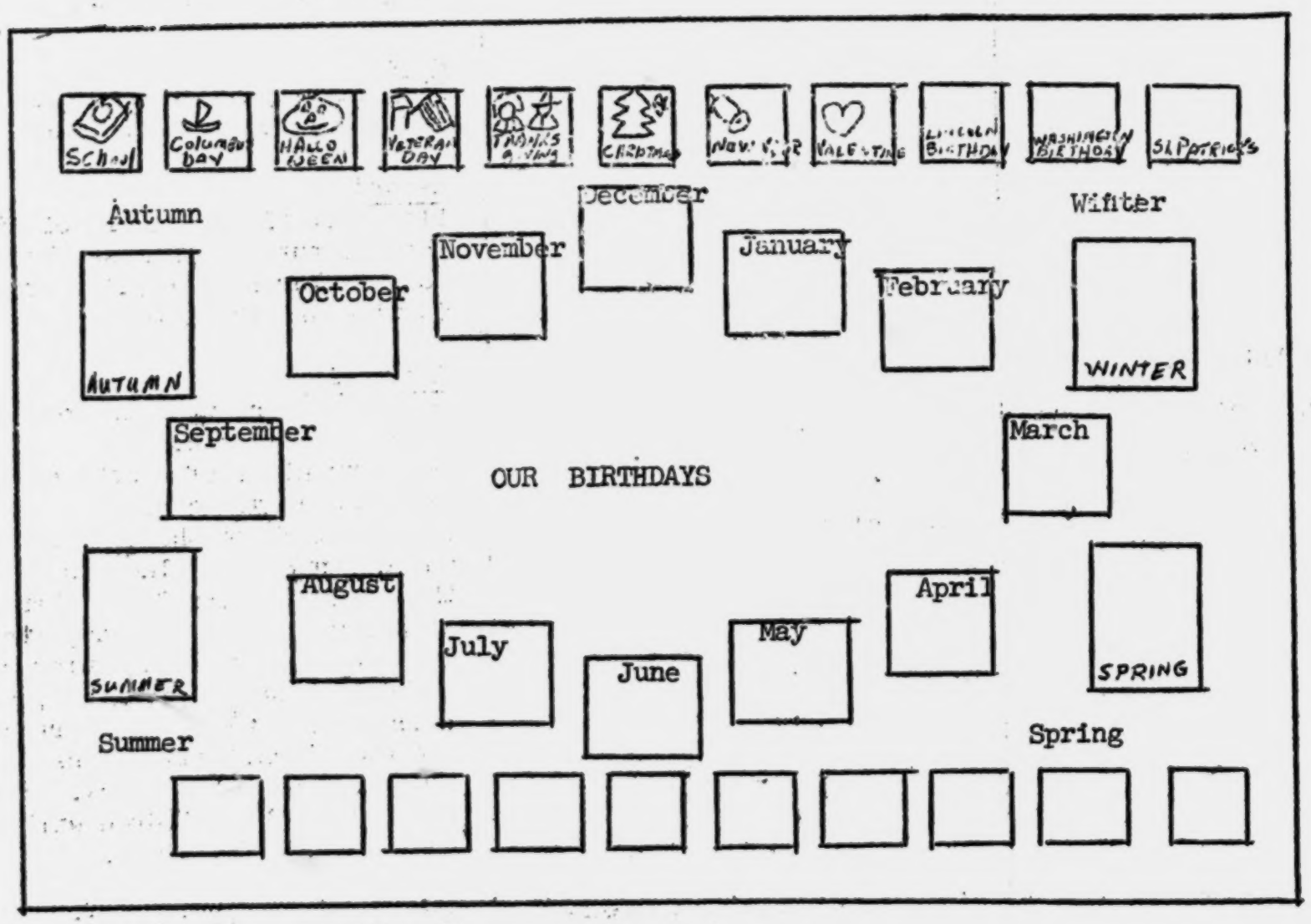
CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
f. Introducing New Subtraction Facts.		**LEVEL I** Maintenance and review must be provided at spaced intervals to insure learning. Children must have many experiences with both concrete materials and work sheets if they are to gain a positive understanding of the number facts. They will need to solve problems and to illustrate them with counters, with flannel cutouts, and with pictures on the chalkboard and on exercise sheets. Ideas for these problems may be taken from seasonal events and activities in the schoolroom.

PRACTICAL APPLICATION OF QUANTITATIVE ABILITIES

Section IV

Level I

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
d. Developing Concepts of Fast and Slow	Use pictures.	Have the children name as many things that move fast as they can. Then as many slow things as they can. Music Play fast and slow music and have the children clap fast and slow, run fast and slow, trot fast and slow. Record Play Walt Disney record of "The Tortise and the Hare". Show pictures. Discuss who went fast and who went slow. Some children will enjoy dramatizing the story of "The Tortise and the Hare".
2. Telling Time		Discussion: How do we know when to come to school? to eat? to start school? etc. How many kinds of clocks do we have? (Show as many pictures as you can.)
a. Clock	Mock clock	Fasten clock to the wall low enough for stdents to reach and manipulate. Place an oak-tag card beneath the clock that reads, "Time for". Beneath this a pocket for slipping in cards to complete sentence. Tack conveniently near an envelope containing cards on which are printed, "school", "home", "recess", and "lunch". At first the teacher will place the correct word in the pocket and set the clock, telling the class as she does, "The next hour will be ten o'clock. This is time for recess, isn't it?" Soon the children will be able to pick the correct word and set the clock.
b. Calendar	Calendar - A pocket calendar on which each date is placed a day at a time by the children. Bulletin board - Make a large bulletin board relating the calendar to time, important events and seasons.	Questions for discussion: 1. What is a calendar? 2. Name of the months. 3. Name of the days. (Begin with Sunday) 4. Number of date. 5. How many days in a month? 6. What date is your birthday?


School
Columbus Day
Hallo ween
Veterans Day
Thanks giving
Christmas
New Year
Valentine
Lincoln Birthday
Washington Birthday
St Patrick's
Autumn
Wifiter
November
December
January
February
October
AUTUMN
WINTER
September
March
OUR BIRTHDAYS
August
July
June
May
April
SUMMER
SPRING
Summer
Spring

CONTENT

B. Money

1. Recognition of coins

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

Begin with real money to teach the child the value of the small coins. He will then have a correct image of the coins about which he is studying. After the correct concept has been established, use play money. Work with the child independently until he has learned a few values. Then let him work in group activities with children who are on about the same level of ability in handling money.

Have the child close his eyes and see if coins of different size sound the same when dropped on the floor or desk top. Have him close his eyes and see if he can arrange them by size--dime, penny, nickel.

Identify the name of the coins, using real money; pennies, nickels, dimes. Ask the child, "Give me 2 pennies." and similar questions. Show the child that a nickel is worth as much as 5 pennies, or that you can buy as much with 5 pennies as with a nickel. Go slowly! This a difficult concept.

A schoolroom display of the actual coins might be retained for reference. In making the display cards a hole should be cut in the cardboard holder for the coins so that the children may see either side of the coins by turning the card over. The money may be held securely in place with pieces of transparent tape. The class should discuss the fact that all coins do not have the same design on them,
but that all of them do say how much they are worth,
and that those of the same value are alike in size.

After the children have learned to recognize the real coins and to know their respective names, turn to exercises to develop the child's understanding further.

One such exercise that can be used often is to provide several articles with price tags. Stick of candy 3¢, lollipop 1¢, cookie 2¢, candy bar 5¢, top 3¢, small doll 4¢.

CONTENT

RESOURCE MATERIALS

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL I

Write this sign--¢--on the board. "This sign means cents. When you see this sign call it cents."

Name the things the children can buy and how much they cost.

1. Find the things that cost 2¢.
   Show me 2¢.
2. What costs 3¢?
   Show me 3¢.
3. What costs 4¢
   Show me 4¢.
4. What cost 5¢
   Show me 5¢
5. Which cost more: the horn or the cookie?
6. Which cost less: the balloon or the pencil?
   Move the pennies into 2 rows so the "less" can be seen.

Introduce one coin at a time, review the ones already introduced.

Learning to make change or combining coins are too difficult concepts for this level .

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES
C. Linear Measurement		
1. Awareness of distance		LEVEL I The E.M.R. child has great difficulty in recognizing distance. Since the idea of any linear measurement is vague and incomprehensible to them, things are usually referred to as far away, close, not very big, big, tall, not very tall. These concepts should be used as a basis for enlarging and extending the values of measurement.
2. Self measurement	Before class prepare a strip of paper 2 or 3 inches wide and 50 inches long. This can be made by cutting strips from paper 9 x 12 inches and pasting the strips together to make a 50 inch strip; or a continuous strip can be cut from butcher or wrapping paper. On this strip mark off the inch spaces. Number each inch. Fasten this strip to the door frame from the floor up. Thumb tacks or tape may be used to hold it. Provide a stick or ruler to place on child's head to measure his height.	The child becomes aware of the value of measurement and of the inch as a unit of measurement when the school nurse weighs and measures the child. At this time, when the child is interested in measurement show him a ruler and one inch and etc. to 12 inches. Since many of the children cannot count to twelve in the level one group it will be impossible for them to measure many things. However at this point the words foot ruler should be introduced Measuring activity Today we shall find out how tall each child in our class is. Are all the children in our class the same height? Which one do you think is the tallest? Does any one think someone else is the tallest? If there is a difference of opinion write the names on the board. Do the same with the shortest child. Choose a child, have him stand up to the measuring stick. Choose another child, have him take the ruler or stick and hold it over the child's head who is being measured. Be sure the ruler is straight and points to the measuring strip. Write child's name and height on the chalkboard. Make a list as the children are measured in turn. When the height is slightly more than an even inch use a + sign, when less use a - sign. Determine who is tallest and who is shortest.

CONTENT	RESOURCE MATERIALS	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
D. Liquid and Dry Measure 1. Recognition	Play store Materials for making cookies	LEVEL I The E.M.R. child in level I will not study the relative aspects of pints and quarts or pounds and ounces but in the process of playing store should be taught to recognize a pound of coffee, nucoa or butter, etc., a pint of half and half, a quart of milk and a half gallon of milk, etc. If it is possible to cook, the things for measuring the many things that go into cookies can be taught such as a cup, a teaspoon, a tablespoon, a carton of eggs: how many are in the carton? (Call on someone who can count to twelve) How many will we use? The recipe should be written on the board so those that can may follow it

CONTENT	RESOURCE MATERIALS	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
G. Geometric Forms		
1. Recognition and relationships	Form boards Peg boards Marble boards Numerous objects of the desired geometric shapes	**LEVEL I** Children at level I should recognize and be able to name circles, squares, triangles and rectangles. Construct pictures using pre-cut shapes: Houses, trees, animals, etc Can be formed by pasting pre-cut shapes according to directions given by the teacher. Use peg boards and marble boards to illustrate geometric forms. Have children copy design on their own board. Repeat a design from memory.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
I. Problem Solving Devices		LEVEL I
1. Translating real situations into workable mathematical problems		The arithmetic classroom should be a learning laboratory. In this laboratory, the children should engage in a wide variety of concrete, meaningful experiences in which numbers play an essential role. Such experiences include grouping and manipulating objects, constructing simple things, and dramatizing number situations, all of which contribute to the discovery and understanding of number meanings. The teacher should keep in mind how a child learns: "What I hear I may forget, What I see I may remember, But what I do I will know." Under the teacher's guidance, the children should work with manipulative materials and visual aids in such a way that numbers will have meaning to them. These activities should be conducted in such a way that the children will discover quantitative information and number relationships.

LEVEL II

DEVELOPING A VOCABULARY OF QUANTITATIVE TERMS

Section I

Level II

I. DEVELOPING A VOCABULARY OF QUANTITATIVE TERMS - LEVEL II

A. DESCRIPTIVE TERMS

connect
fat
liquid
present (not absent)
shape

B. COMPARATIVE AND MODIFYING TERMS

1. COMMON COMPARATIVE WORDS

large, larger, largest
short, shorter, shortest

2. NUMBER WORDS

ones
one to ten
one-half (of a set)
one-half cup
one-half dollar
one-half as much
one-half dozen
thousand, thousands
million
one-fourth
one-half gallon
one-half mile
one-half pint
one-half inch
one-third

3. WORDS THAT TELL "WHERE"

there

4. WORDS THAT TELL "WHEN"

hour
since
minute (time)
second (time)

VOCABULARY - LEVEL II

5. WORDS THAT TELL "HOW MANY" OR "HOW MUCH"

half-dozen
half of a set (half the class)
length
once
degree (temperature)
herd
several

C. TERMS RELATED TO MATHEMATICAL PROCESSES

altitude - the vertical distance. "The jet is flying at a higher altitude than the prop plane."

area - the measurable surface contained within any plane geometrical figure. "You stay in this area of the playground."

associative property of addition - It is possible to add only two numbers at one time. If you add 3 numbers you add 2 numbers first and then add the third number to the sum of the other 2. The grouping does not matter in addition. The final sum will be the same regardless of which 2 numbers are added first. (3+4) + 5 = 3 + (4+5).

associative property of multiplication (see above) - In multiplication also, the grouping does not matter. The final product will be the same regardless of which two numbers are multiplied first.

(2 X 5) X 7 = 2 X (5 X 7)
10 X 7 = 2 X 35

borrow --a colloquial term used in subtraction to indicate regrouping the minuend to make the subtraction possible. It is used when a digit in the subtrahend is larger than the corresponding digit in the minuend.

$$\begin{array}{rl} & \overset{5}{} \\ 65 = & 6 \text{ tens} + 5 \text{ ones} = 5 \text{ tens} + 15 \text{ ones} \quad \not{6}^{1}5 \\ \underline{-29} = & \underline{2 \text{ tens} + 9 \text{ ones} = 2 \text{ tens} + 9 \text{ ones}} \quad \underline{2\ 9} \\ & 3 \text{ tens} + 6 \text{ ones} \quad 3\ 6 \end{array}$$

brackets, braces - A symbol used to indicate that the enclosed numerals or symbols belong together. Sometimes used instead of parentheses, especially when one set parentheses has already been used. Used for sets when the members of the set are are named.

VOCABULARY - LEVEL II

C. TERMS RELATED TO ... (Cont'd)

carry - a colloquial term used in addition to indicate changing the form of the sum. It is used when the sum of a column is ten or more (if ten is the base).

85 = 8 tens + 5 ones
47 = 4 tens + 7 ones
12 ones = 1 ten + 2 ones

$$\begin{array}{r} {\scriptstyle 1} \\ 85 \\ 47 \\ \hline 132 \end{array}$$

check - to verify that a problem is correct, usually by working it in reverse order.

column - a term for all numerals in a problem that have the same place value. The word is most commonly used in columnar addition.

combination - the possible arrangements of two one digit numbers under the four operations. The possible combinations of 2 and 3 are:

2+3 = 5 2 ÷ 3 = $\frac{2}{3}$ 3 ÷ 2 = $\frac{3}{2}$ or $1\frac{1}{2}$
3-2 = 1
2 X 3 = 6

commutative property of addition - the sum of two numbers is not affected by reversing their order. Thus 4 + 5 = 9 and 5 + 4 = 9.

commutative property of multiplication - the product of two numbers is not affected by changing their order. 5 X 6 = 30 and 6 X 5 = 30.

dividend - the name of the term which is to be divided in a division problem.

division - the process of separating a set into equal subsets.

double

empty set - a set that has no members. Example: The set of United States Senators who are under 21 years of age.

equal, equals - another name for a number-a combination with a value equal to the number.

3 + 4 is another name for 7
3 X 4 is another name for 12
4 - 3 is another name for 1
8 ÷ 2 is another name for 4

VOCABULARY - LEVEL II

C. TERMS RELATED TO ... (Cont'd)

equal sets - two sets which have exactly the same members, hence are the same set. (See also "equivalent sets").

equivalent sets - two sets which have exactly the same number of members. The set made up of the letters A,B,C and the set made up of the letters X,Y,Z are equivalent sets. (See also "empty sets").

even numbers

fraction

gallon

inch

join sets - in arithmetic to add. In set theory to make up a set which contains every member of either set. Members contained in both sets are included only once. Thus, if a set made up of the letters A,C, were joined with the set B,C,D it would form the set whose members are A, B, C, D.

left (remaining)
liquid measure
minus
minus sign
multiply - the process of repeating like groups.
multiplication

natural numbers - the counting numbers - 1, 2, 3, etc.

odd numbers

one-to-one correspondence - equivalent sets. There is a member of the first set for each member of the second set and a member of the second set for each member of the first set.

ordinal numbers - the numbers that show order as first, second, etc.

pint

placeholder - any symbol used to hold a place. The term is also used for numerals which affect the place value of other numerals by their presence.

pound
penny, pennies
plus, plus sign
point
product - the answer in multiplication
profit

C. TERMS RELATED TO ... (Cont'd)

quart
quarter

rectangle
remainder

scale, scales
sign
speedometer

subtract, subtraction - Determining how much larger one number is that of another number. The inverse of addition.

solid
sum

table - a systematic arrangement of data

tens (count by tens)
thermometer
thirds

word problem

N U M E R A T I O N

Section II

Level II

CONTENT

II. NUMERATION

A. COUNTING WORDS IN ORDER

1. Review of Numbers one through Ten

2. Teen Numbers

B. CONCEPTS OF NUMBERS

RESCURCE MATERIAL

Materials:
--Chipboard
--Blocks or beads which can be strung,
--Heavy cord to fit through beads.

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

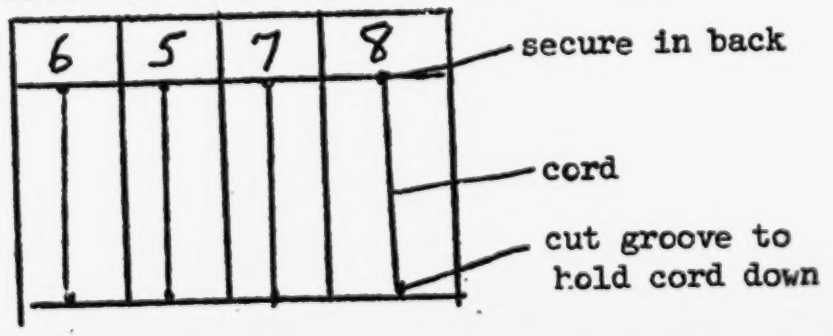
Number concepts, formation of the symbols, number names and serial order are reviewed thoroughly before new material is presented. At this level review of each number individually is not ordinarily necessary. Numbers 1, 2, 3 are taken together; then 4, 5, 6 followed by 7, 8, and 9. Ten is taken separately and review of tens and ones immediately follows.

A brief review of rote counting and of serial order to 20 prepares the child for development of the understanding of teen numbers. The teacher then presents rational counting to 20 followed by practice in reading teen numbers as she writes them (isolated, not in sequence) on the blackboard. Similarity between teen numbers and related single digit (i.e. 13 and 3) is pinted out as an aid both in reading and writing teen numbers. The child next learns to write the teen numbers from teacher dictation. Development of the tens and ones concept would appropriately follow.

Children should be given every opportunity to read numbers of pages, calendar, counting papers to be collected, counting number of children present, or eating lunch etc.

A thorough review of concepts previously presented should be given. Each number should be taken individually with emphasis being placed on its internal composition.

Continued practice with concrete objects is necessary. Children usually enjoy using a simplified version of the abacus at this level. The following manipulative game can easily be constructed for help in this concept.



CONTENT

RESOURCE MATERIAL

9" by 12" tagboard

SUGGESTED TEACHING TECHNIQUE AND ACTIVITIES

Level II

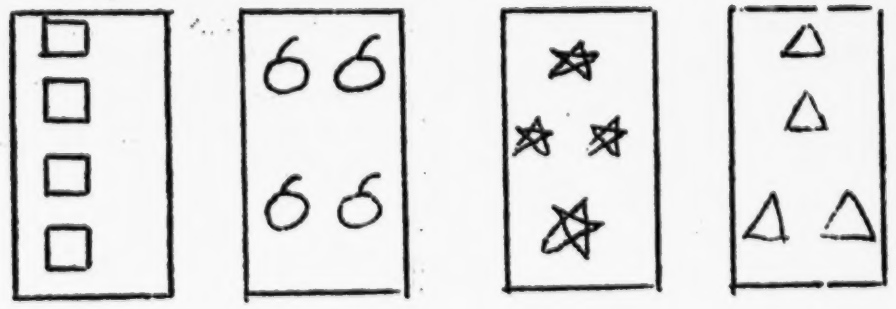
End of cords may be dipped in Withhold glue to prevent raveling and to make for easier stringing.

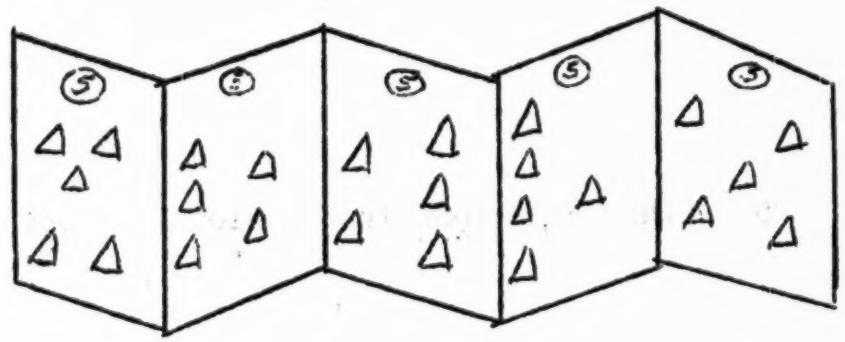
Everything that the child has learned about the number should be drawn together in enriching the concept. Finding the number on the calendar, on the clock face, as a page number, that number of pennies, and so on. The child continues to need stimulation to an awareness of the occurence of numbers in the world about him.

The child should be able to recognize the number symbol instantly and accurately. He should be able to associate it meaningfully with objects, real or pictured, before the number name is introduced

Groupings for two and three are taught at the Level I, groupings for four, five and six at Level II. It has been found impractical to require the child with mental retardation to learn groupings beyond this number. The children should also have learned at Level I that these groupings are referred to as sets.

Four: Use a variety of large cards bearing pictures of sets of one, two, three, and four, and play a game with the children. Be sure that the sets that are pictured on the cards are arranged to form different patterns. Hold up one of the cards. Tell the children that they must tell how many are in the set without counting. Continue the activity. Mix up the cards from time to time. Build up speed in flash recognition of the sets by exposing the cards for shorter and shorter periods of time.



CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUE AND ACTIVITIES
		LEVEL II
	Long strips of plain newsprint	Five: Help the children make their own accordion-fold, number booklets. With the number 5 at the top of each each page, have the children draw some geometric shapes, with a different arrangement of the shapes on each page. 
C. NUMERAL RELATIONSHIPS		
1. Writing Symbols		The child's formation of the number symbols should be checked individually by the teacher. Blackboard practice accompanied by repetition of instruction for formation is especially helpful.
2. Number Names		The concept of number names can be introduced to the child by pointing out that just as he may have two names, one short or nickname and one longer name, so, too, do numbers have a short name (symbol) and a long name (written number name). After the association is made between the symbol and number name, the relationship between name and objects is emphasized. By means of drill and independent work exercises the child learns to interchange, with understanding, the objects, symbol and number name.
3. Differentiating Symbols	For teacher made playing cards:	If the child shows any confusion in distinguishing between number symbols, independent work exercises and game drills might be necessary. Teacher-prepared playing cards or commercial playing cards with the pictures omitted can be used as a variation of "Old Maid".

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		Level II (The child is required to draw a card from his neighbor, to pair it with one he holds and place them face down in front of him. He retains cards until they can be paired. The child who holds the one odd card at the end of the game is the loser.)
4. Serial Order		Each number as it is reviewed should be placed in serial order by the child. The number that comes <u>After</u> is relatively simple to master, but extended practice is often necessary to master the number that comes <u>before</u>. It is usually preferable to space short drill periods over a long interval of time.
5. Other Relationships	Blocks, pencils, books, etc.	Using educational blocks of various colors, the teacher demonstrates that 2 is 1 red block <u>and</u> 1 blue block; 1 red block <u>and</u> 1 blue block <u>are</u> two; one set and one set <u>equals</u> a set of 2; 2 is 1 <u>more than</u> 1; 1 is 1 <u>less than</u> 2. Children are not required to memorize these numberfacts, but learn to see that putting things together results in a bigger group, or more. Terms stressed in oral discussion are: <u>and</u>, <u>are</u>, <u>equals</u>, <u>many more</u>, <u>many less</u>. <u>Equals</u> is presented as synonymous with are and is. After the terms are clearly understood, the teacher continues to manipulate the blocks in simply structured problem solving situations. Care must be taken to use precise language so that the concepts of union of sets and of addition of numbers do not become confused in the mind of the child. When dealing with union of sets, the term join is appropriate. <u>Add</u> and <u>plus</u> must be reserved for work with numbers. Avoid speaking about adding sets; never use a plus sign between pictures of sets. When the children have had sufficient time to observe the teacher manipulating the blocks, they are instructed to do so also, using the vocabulary previously presented. Practice is then carried on with flannelgraph objects. Independent work assignments consist of completing designated groups.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL II
		The preceding procedure is followed for all possible component variations of the numbers 2 through 7. The concept of zero as a number meaning no more (2 is 2 blocks and no more; 2 is 2 and 0) is presented individually and then integrated into the other instruction. The word "nothing" should be used only when the teacher refers to the contents of the empty set. Zero is something; zero is a number, sometimes used as a placeholder.
	9" by 12" cards with illustrations of sets from zero to 9.	Place set cards zero through nine in random fashion in the chalk tray. Have a child put them in order and writ the corresponding numeral above it on the board.
D. CARDINAL, ORDINAL AND WORD RELATIONSHIPS		
1. Learning Ordinal Numbers		Conversational use of the terms first and last ordinarily renders them easily understanda Use terms in classroom directions as, "The first one in each row may pass out the pencils.", or other materials. Use of the calendar to establish the difference between 1 and first; 2 and second.
	SRA Math	Practice assignments of independent work in finding and naming the first, second and last should precede introduction of third and fourth, later fifth and sixth. Special attention is called to direction toward which the objects or pictures are facing in establishing first.
		Activity: Place five objects in a row on the flannel board. Establish the beginning point as the left of the row. Point to each object in turn. Explain that the rabbit is the first object in the row, that the bird is second, etc.

Continuing this activity, change the objects around so that a given object is not associated with any one

CONTENT

RESOURCE MATERIAL

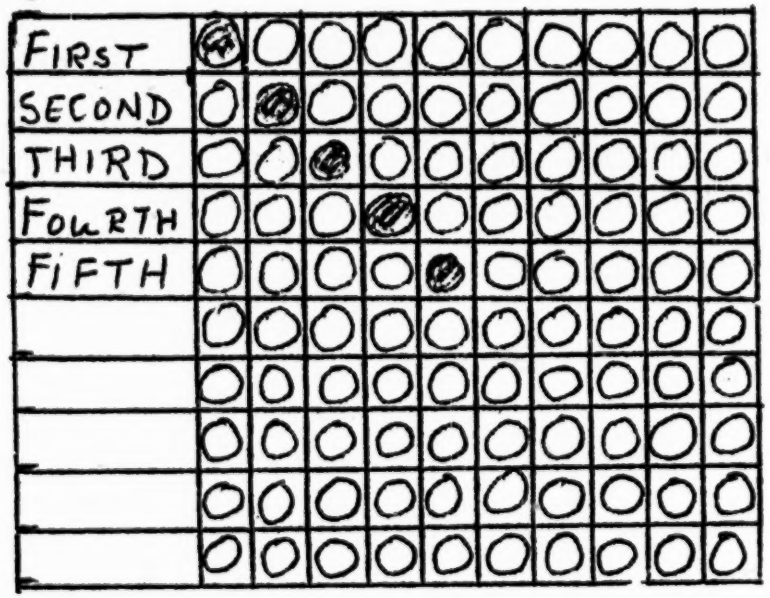
SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

Level II

position.

To vary the activity, tell the children that you are thinking of the bird. Ask some child to tell its positio in the row.

Children should be introduced to the written words first, second, third, fourth and fifth, but should not be expected to remember the words. A chart similar to this may be helpful.



With the help of this chart and if the children know color words an exercise like this may be helpful.

Distribute newsprint and ask the children to make 5 squares in a row on their paper. On the board write these directions:

Color the second ▱ green
Color the fourth ▭ red
Color the first ▭ yellow
Color the fifth ▭ orange
Color the third ▭ blue

2. One-to-One Correspondence

To the terms enough, not enough and too many, introduced at the earlier level, is added the term more is needed. Through the use of objects and pictures the child is led

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL II
3. Understanding "More"		to the solution of the problem: 1) How many more are needed? For example, here are three dogs, but there are only two bones. What is the matter? We need more bones. How many more? How many dogs do not have a bone? Structure classroom situations to elicit terms indicating that more is needed. Introduction to the solution to how many more are needed as a subtractive process can be made by directing the child to match objects of one set to another and then remove the paired objects. The words not enough to go around may be used. The terms take-away and how many more are needed should be firmly linked in the child's mind. Children should be encouraged to make their own sets from available classroom materials and explain to a partner or to the teacher the concept of one-to-one correspondence. They should be encouraged to use the words, How many more are needed, or not enough to go around. Appropriate objects and pictures should be used for introducing the terms: One for each, more than enough, as many as, the same as, many, few, fewer.
E. READING AND WRITING NUMERALS 1. 10 to 20		Rote counting skill is extended to 20. Tapping, clapping and marching as the numbers are said helps the child to associate each beat with a number. Drill should be continued until the child can correctly pronounce each number to 20.
2. 20 to 100		From 20 the skill is extended to 100. A number chart with the numbers reading from left to right horizontally, and with 11, 21, 31 etc., listed vertically under 1, and 12, 22, 32, under 2 and so on is used to point out the similari of ones place endings and the progression of the tens place digit.

CONTENT

RESOURCE MATERIAL

Dot to dot books

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

Level II

The teacher carefully notes whether the children are able to begin each new decade with assurance. Work with the skill of counting by tens until the child is thoroughly familiar with the decade names (twenty, thirty, forty etc.) Objects such as counting, blocks or sticks should be used a few times to give the child some idea of what quantity is actually represented by 100.

A variety of dot-to-dot pictures are enjoyable and good drill work for rote counting. Physical fitness exercises are a good time to practice counting. The counting can be varied with any exercise. Sometimes count by ones, sometimes by 2's, sometimes by 5's or 10's. Count days of the week or months to an exercise.

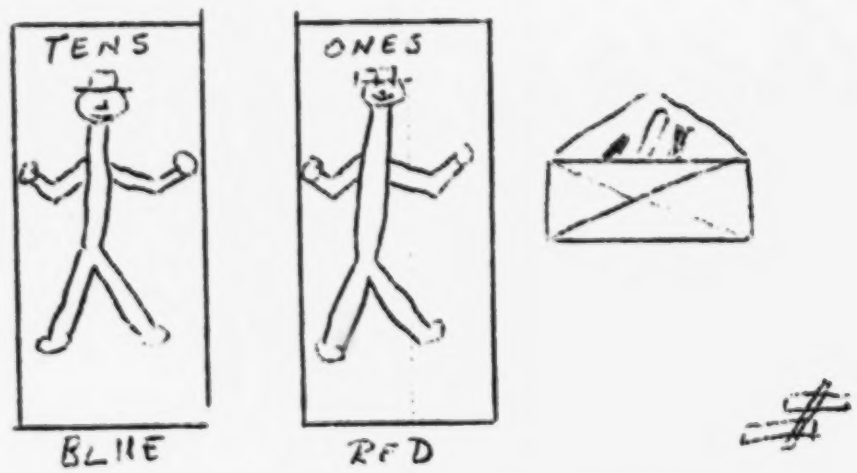
Introduction of the concept of counting groups is presented as counting by 2's. The teacher shows the children 10 counting cubes arranged in pairs (2 red, 2 blue, etc.) Moving each group, she says: "Here are two, and another two, and another two (to ten). How many are there in all?" The teacher then moves two at a time, whispering the odd numbers and pronouncing the even numbers aloud. The children imitate this procedure a few times.

The blocks are then turned over and the number symbols previously pasted on are displayed. The teacher then turns down the odd number symbols and asks the children to read the remaining even numbers. Drill in counting by 2's to 10 is varied by directing the children to count eyes, ears, shoes, hands, pennies, children, etc.

When the mastery of counting by 2's to 10 has been achieved, the even numbers to 20 are introduced. The numbers 12, 14, 16, 18, and 20 are written on the blackboard directly below their single digit base number.

Counting of objects, real, then pictured, follows. Independent work furthers the skill of writing by 2's to 20.

The terms pair, double, and couple are presented as an enrichment of the concept of counting by 2's. Groups of

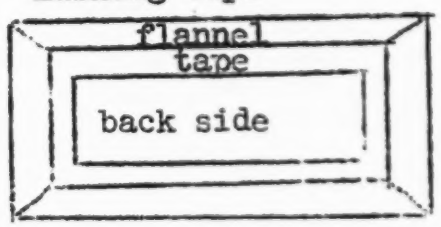
CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL II
F. PLACE VALUE AND PLACE HOLDERS		two are referred to as a pair of, or double. A group of two people, such as in dancing is referred to as a couple. The development of an awareness of the concept of tens and ones and of <u>place value</u> is introduced at Level II. Rote counting to 20 is a necessary prerequisite. Write the numbers one through nine in a vertical column on the blackboard. Write the number ten placing the zero directly under the sin le digits. Point out to children that there are two digits. The term place is introduced; this number has two places. Ten objects are then used: apples, cookies, or anything that can be joined visibly by a binding factor such as a plate or transparent container. The children count the ten objects and are told that this is a group of ten, a <u>ten</u>. After identifying the group of <u>ten</u>, a few scattered objects are then identified by the teacher as <u>ones</u>, loose ones, not enough to make ten. Counting man on $8\frac{1}{2}$" x 11" pieces of tagboard.  Provide one set of counting men for each child, also have available either an envelope of brightly colored paper strips or 20 clothes pins per child.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
G. APPROXIMATIONS AND ESTIMATES		**Level II** Place a number of objects on the flannel board, and have the children record the count on their countingmen cards. Hold up a numeral and have the children show the number it represents by placing fingers on the countingmen. Beginning with a vertical column of single digit numerals, the teacher re-emphasizes the meaning of ten and the teen numbers as two place numbers; the importance of placing ones under ones and tens under tens is also introduced. Develop the concept that zero is a place holder, that it keeps the 1 (or other numeral representing tens) in its proper place and does really indicate a numerical value. Provide opportunities, related to life situations, for estimation. Questions can be directed to the child during instructional periods other than arithmetic: "Whom do you think is older, your mother or you?" "About how much do you weigh?" "Is that more than your father weighs?" "Which do you think is longer, a day or a week?" "Which do you think costs more, your Daddy's car or your bicycle?" "Is a dog house higher than your house?" "Is _____(a place less than a mile away) farther than (a place more than 100 miles away)_____?" "Is there more milk in a cup or a gallon?" Because retarded children are usually weak in the ability to generalize, practice of this nature is an important aid to their developing the ability to make sensible estimates.

DEVELOPING THE BASIC ARITHMETIC PROCESSES

Section III

Level II

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL II
III DEVELOPING THE BASIC ARITHMETIC PROCESSES A. ADDITION 1. Set Union 1+1 1+2 2+1 2+2	Make a flannel board for each child and give each child a stack of two colors or shapes of flannel pieces. Plus some yarn for making the sets. Idea I 1) 9"x12" chipboard (Enough for each child in math group) flannel masking tape  2) Flannel shapes of different colors □ △ ○ ▭ e) yarn Idea II Have an envelope for each child with squares of numbers made from construction paper. Number them from 0 to 10 and make each set a different color. Include also sets of [+] [-] [=] signs.	A sample lesson could be: "Make two sets (Place yarn in ⊃ shape). Put one red square in one set and one blue square in another set. (Teacher does it on her flannel board at the same time using number symbols underneath, such as: 1 + 1 = 2 Now join them together in one set. How many in all? Point out we join sets, and we add numbers. Another day use similar technique using blocks, books, children, pencils, etc. or any available manipulative material. A variety of manipulative materials should be used until the child understands well the concept of add: A teacher should have available 3 sets of numerals available from 0 to 10 for each child. The children can use numbers and the teacher can use manipulative materials to illustrate sets. A sample lesson could be: (Teacher illustrates a set) Place the numeral on your flannel board that tells how many squares are in this set. (Teacher makes another

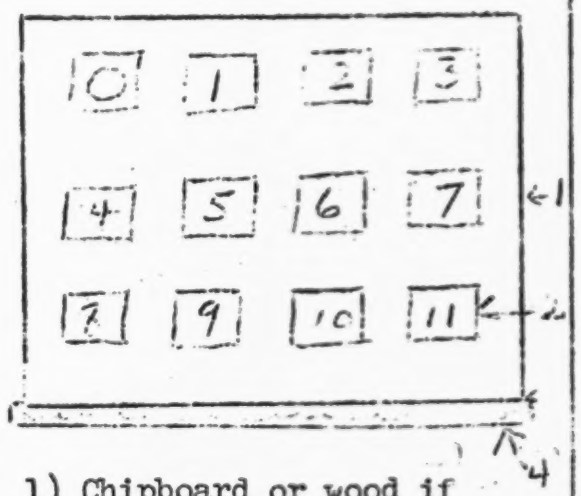
CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

Idea III



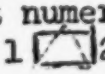
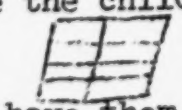
1) Chipboard or wood if available.

2) 3 flannel squares of each numeral with small hole to hang on peg.

3) Hooks or pegs.

4) Wood with groove down center for support.

A teacher should have available 3 sets of numerals from 0 to 10 for each child.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL II
		set and asks child to place a numeral again that tells how many.) When I join this set together how many do I have? Put that numeral in the same row: Example: 1 1  2. "Let's go over it again. Say it with me. One and one are two. Do you have the word and - where is it? What can we use instead?" (Introduce the plus sign. Point out the and and plus mean the same.) Do we have the word are? Where is it? Introduce the equals sign. Point out that are and equals mean the same. Give the children a sheet of newsprint. Fold it into  and have them write problems that correspond with sets teacher makes on flannel board. Put the equation form problem in one box and the vertical form in the other box across from it
2. Using the Number Line.	Elem. Sch. Math. Eicholz, Martin, Brumfiels Shanks, Teacher's Edition Addison-Wesley Pub. Co. - 1963	Tell the children that today they are going to play an interesting game that will teach them to think about addition and subtraction in still another way. Have the children help you tape pieces of paper with numerals on them on the floor in numerical order: 0 1 2 3 4 5 Tape these papers about eight to ten inches apart and in a straight line. Use papers numbered from 0 to 15. Tell the children to pretend that these are numbered stepping stones. Direct a child to stand beside the paper labeled 0 and to take three steps forward along the stones so that he lands on the stepping stone labeled 3. Have all the children participate in counting his steps. Now write the numeral 3 on the chalkboard.

1+1 = 2	1 + 1 2
2+1 =	
1+2 =	
2+2 =	

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

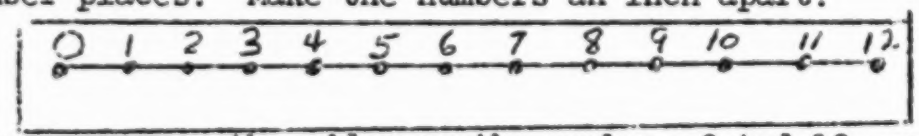
LEVEL II

Next, direct this same child to take four steps forward. Have the children again participate in counting the steps to be sure that he has taken 4 steps. He should land beside the paper labeled 7. Now, write on the chalkboard the numeral 4 beside the numeral 3. Leave enough space between for an addition or subtraction symbol. Ask the children whether Johnny's (or Susie's) moves along this stepping-stone path described addition or subtraction. Point out that he began with three steps, and then took four steps. When someone observes that this is like addition, put a plus sign between the 3 and the 4 and have the children tell you how to complete the equation.

Select another child and have him stand by the 0. Tell him to take 7 steps forward, and you write the numeral 7 on the chalkboard. Again have the children count his steps to be sure that he has taken seven. Now direct him to take six more steps forward, again having the children follow this activity. Write +6 beside the 7. Have the children observe which stepping stone he is on after having taken 7 steps forward and then 6 more steps forward. When they observe that he is beside the paper labeled 13, call attention to the equation 7+6=13. Continue this activity for several more addition combinations, keeping the children involved in each demonstration.

Tagboard 2"x14"

After everyone has had a turn using the floor number line, the children can make their own number lines to use at their seat to use as an aid to answering addition facts. These can be made from stips of tagboard. The numbers from 1 through 12 can be on one side and 13 to 24 on the other side. Use a ruler to make a straight line and mark the number places. Make the numbers an inch apart.



Allow space on the sides so the numbers 0 and 12 can be written. This game may be helpful for reinforcement: "Add On"

Arrange the children in 2 rows. Choose teammates for

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUENAND ACTIVITIES
		LEVEL II
		each row and write it on the blackboard. With a different number under each team name, such as Rockets 4 — Jets 2 When the teacher calls out, "Add on 2" (or some other number) each child in a front seat is to go to the board, and by using number line, add on 2 and write the number below the above number. The student, when finished, returns to his seat, hands the chalk to the next in line, and Teacher calls out "Add on 3" and procedure is followed again. The game goes on until every child has had a turn. The first team finished with no mistakes wins, or scores a point. The reward for winning could be a star pasted on the forehead of each child on the team.
3. Addition Combinations 2+1 1+2 3+1 1+3 2+2 4+1 1+4 3+2 2+3 5+1 1+5 3+3 4+2 2+4 6+1 1+6 5+2 2+5 4+3 3+4 4+4 5+4 4+5 5+3 3+5 etc. up to facts with the sum of nine.	Tape Recorder	Each of the other sets of related addition facts are introduced and developed according to the pattern given for 1 and 1, and 2 and 1. When facts with sums of four and more are presented, a brief review of the component groupings of the sum and of recognition of groups through 6 precedes introduction of the facts. After understanding of the concept is secured, drill periods of widely varying types should be conducted until the child can correctly and fluently give the answers. A new set of facts is not introduced until mastery of those preceding is assured. Drill Exercise ideas: 1) Use the tape recorder. Record those facts you intend to drill within the framework of an easy, rhythmic pattern. The first few minutes of the tape might consist of repetition of the facts in melody or in beat. The next few minutes require the child to supply some responses. The last portion may consist in directions for some form of written response. 2) Those who finish a worksheet assignment of addition could go to the blackboard on which you have put the puzzle of the day. They duplicate it on the board

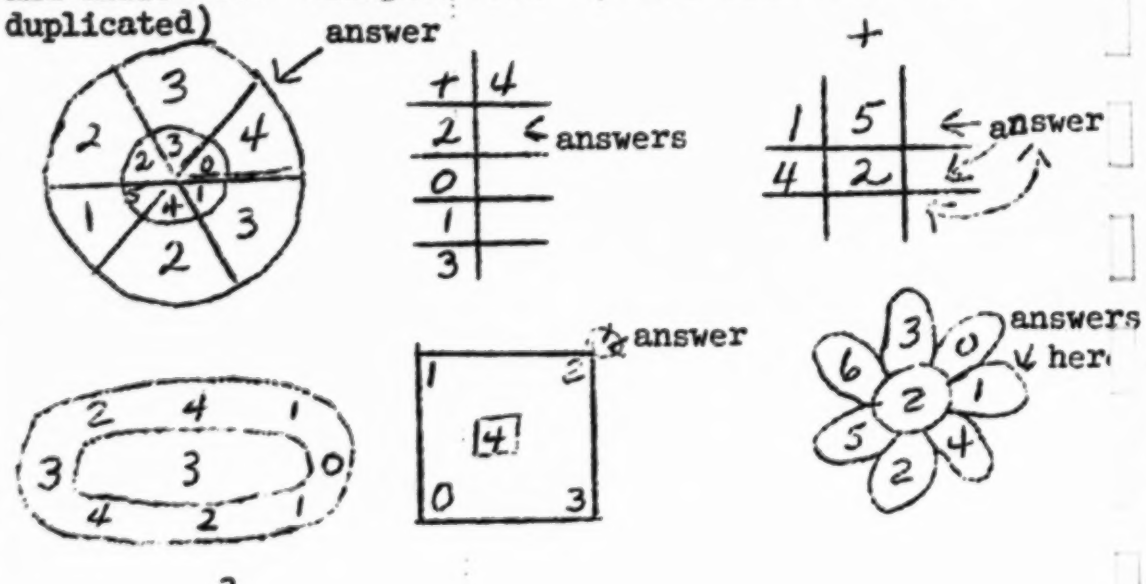
CONTENT

RESOURCE MATERIA

SUGGESTED TEAC..IN TECHNIQUES AND ACTIVITIES

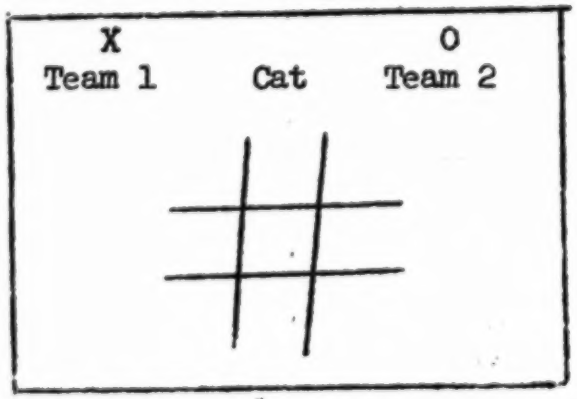
LEVEL II

and answer it. Examples are: (These could also be duplicated)



3

3) Tic-Tac-Toe
Divide the class into two teams. One team is the X team and the other the O team.



Draw the above diagram on the blackboard. The first team member from each team goes to the blackboard. The teacher holds up an addition card (appropriate to the child's level) for the child on team 1. If he reads and answers the addition fact correctly, he then places an X in the place he chooses. If he does not answer it correctly, he can not place the X and must sit down. The teacher then does the same for the child on team 2. After he has placed his O where he chooses, the two players sit down and the next two players go up. The

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

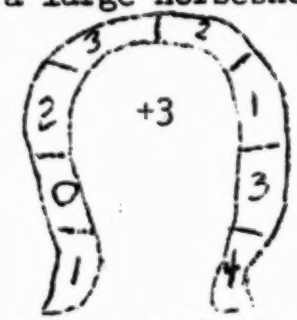
LEVEL II

4. Commutative Property

Games for Arith.
Ginn. Co. Boston
#575-11-59

The game continues until some team gets three in a row, or if this does not happen, the cat wins the game.

4) Horseshoe
With chalk, draw a large horseshoe on the floor, as shown.



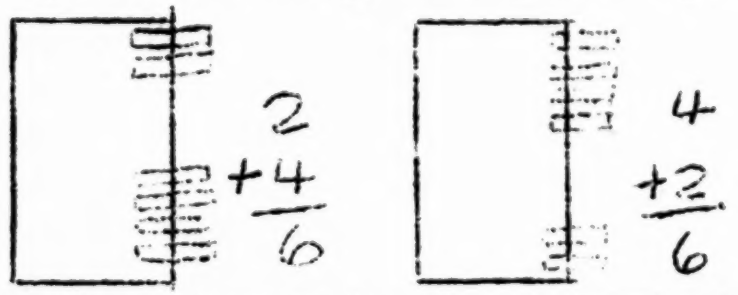
Players are to bounce a ball in each block in succession, giving, as they do, the sum of the number in the block and the number in the center of the horseshoe. If a child gives a wrong sum, another child takes his place. The first player to go around the horseshoe is the winner. The number in the center is chosen by the teacher, and may be changed, as may be the numbers in the horseshoe to keep the game interesting. (Subtraction facts may also be used.)

Two or more horseshoes may be drawn and used in team competition. Each child who successfully completes the facts scores a point for his team.

Another alteration of this game may be to draw the horseshoe on the board and have the children throw bean bags and give the sum of the number he hits with the center number. The number of attempts to throw should be limited to three.

Children should be introduced to the commutative property of addition, although the word commutative need not be required as part of their vocabulary. It may become a part of the children's vocabulary if it is used by the teacher many times.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL II
	SRA Math	Ideas for introducing the commutative property: 1) Choose one child each week to count the number of children present in the room each day. Have the child write the sum of the boys and girls on the board, both ways: 9 girls + 6 boys = 15 children and 6 boys + 9 girls = 15 children After the children are accustomed to doing this, point out that these are showing addition has the commutative property. This word means it doesn't matter if the highest or lowest number comes first, or is on top. 2) Clip two red clothespins on a heavy strip of cardboard; clip four yellow pins under them. Ask the children to tell the joined-sets story, reading from top to bottom.



Then hold the card up to the flannel board. Have the vertical notation form of the number combination placed on the board. Turn the card upside down, and have the set-story read from top to bottom. Again hold the card up to the flannel board and have the vertical notation form of the number combination placed on the board. Continue the activity with addition combinations related to sums not greater than six; include the number zero.

5. Associative Property		Children should be introduced to the associative property of addition, although, as in the case of commutative, the word associate or associative need not be required as part of their vocabulary.

CONTENT

RESOURCE MATERIAL

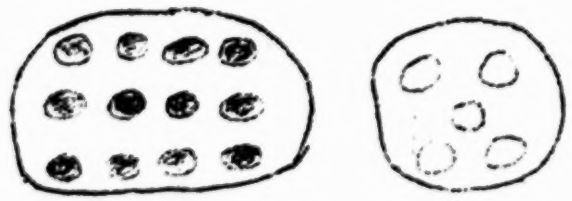
SUGGESTED TEACHING MATERIAL AND ACTIVITIES

LEVEL II

the flannel board.

For example, place a set of 12 blue flannel circles and a set of 5 red circles on the flannel board. Put the numerals 12+5 under the sets.

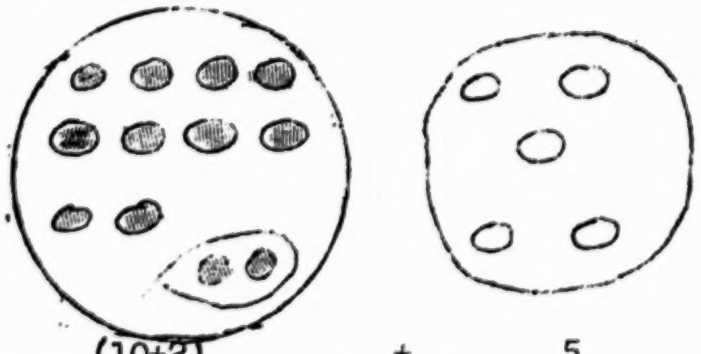
Step 1.



12 + 5

Take 2 blue circles from the set of 12 and put them in a separate set within the set of 12.

Step 2.

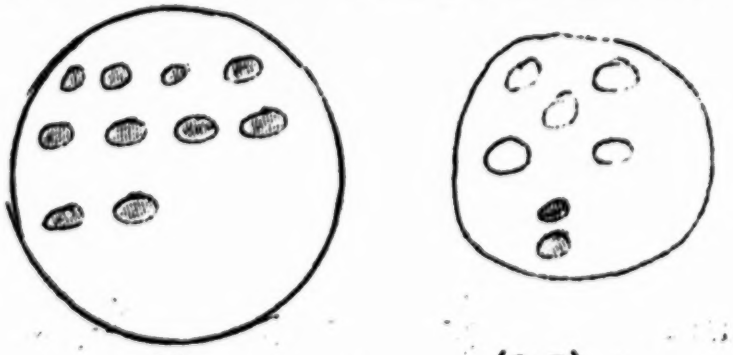


(10+2) + 5

Some children may recognize the associative property here.

Next, remove the set of 2 blue circles and place them with the red circles, again writing the numerals below.

Step 3.



10 + (2+5)

Finally, show how this is simplified by simply writing it as 10+7.

LEVEL II

In conclusion, it should be reviewed that what started out to be 12+5 ended up to be 10+7 which is the same.

A variety of examples with a variety of materials should be used until the child clearly understands the process. It should also be illustrated by writing the numerals vertically.

Much practice should be given before adding of other two-place numbers is introduced. After much teacher-directed activity stressing the need to start with the ones column, some independent work is assigned. The teacher goes about among the group to check that the ones column is really the first to be added by each child.

Review of the tens and ones concept and adding of two-place numbers (without carrying) provides readiness for extending skill in column addition of adding (illustrated below)

1) three two-place addends, then to adding
2) four two-place addends and finally to adding a column with both
3) one-and-two place addends. Adding
4) three-place numbers appropriately follows.

(1)	(2)	(3)	(4)
21	21	21	321
14	14	4	114
+32	32	32	+232
	+20	+ 2	

(See section on columnar addition.)

CONTENT

7. Carrying

RESOURCE MATERIAL

Elem. Sch. Math.
Eicholz . Martin . Brumfiel
Shank
Addison-Wesley Pub. Co., Inc.
Palo Alto, Book 2

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

Exhibit for the children a set of 35 objects (popsicle sticks, pencils, etc.) and a set of 8 objects. Write on the chalkboard the combination:

$$35 + 8 = \text{ and/or } \begin{array}{r} 35 \\ +\ 8 \\ \hline \end{array}$$

The set of 35 objects should be grouped by tens to show clearly 3 tens and 5 more.

Ask the children to take enough from the 8 to place with the set of 35 to make a set of 4 tens. Have someone come forward to do this. On the chalkboard show --

$$35 + 8 = 40 + 3 \quad \text{and/or} \quad \begin{array}{r} 35 \\ +\ 8 \\ \hline \end{array} = \begin{array}{r} 40 \\ +\ 3 \\ \hline \end{array}$$

and call attention to the new arrangement of the sets, that now shows 4 tens and 3 more.

Repeat this until the children understand the idea of going from one decade to another in this regrouping process.

When this concept is clearly understood the children are ready to do examples such as this

Step 1.

$$24 + 7 = 20 + (4+7) \quad \text{and} \quad \begin{array}{r} 24 \\ +\ 7 \\ \hline \end{array} = \begin{array}{r} 20 \\ 4 \\ +\ 7 \\ \hline \end{array}$$

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

Step 2.

$$20 + (4+7) = 20 + 11 = 31$$

and

$$\begin{array}{r} 20 \\ 4 \\ +\ 7 \end{array} \quad = \quad \begin{array}{r} 20 \\ +11 \end{array}$$

Step 3.

$$\begin{array}{r} 20 \\ 4 \\ +\ 7 \end{array} \qquad \begin{array}{r} 20+4 \\ +\ \ 7 \\ \hline 20+11 \\ \hline \end{array} \longrightarrow \begin{array}{r} 24 \\ +\ 7 \\ \hline 11 \\ \hline \end{array} \longrightarrow \begin{array}{r} 20 \\ \hline 31 \end{array}$$

or

$$\begin{array}{r} 24 \\ +\ 7 \end{array} \qquad \begin{array}{r} 20+4 \\ +\ \ 7 \\ \hline 20+11 \\ \hline \end{array} \longrightarrow \begin{array}{r} 24 \\ .7 \\ \hline 11 \\ \hline \end{array} \longrightarrow \begin{array}{r} 20 \\ \hline 31 \end{array}$$

Following the understanding of this concept, the children will be ready to do computation exercises:

$$\begin{array}{r} 64 \\ +\ 9 \\ \hline 13 \\ +60 \\ \hline 73 \end{array} \qquad \begin{array}{r} 7 \\ +38 \\ \hline 15 \\ +30 \\ \hline 45 \end{array} \qquad \begin{array}{r} 84 \\ +\ 6 \\ \hline 10 \\ +80 \\ \hline 90 \end{array}$$

Exhibit for the children a set of 34 objects and a set of 46 objects which are grouped by tens, so that the

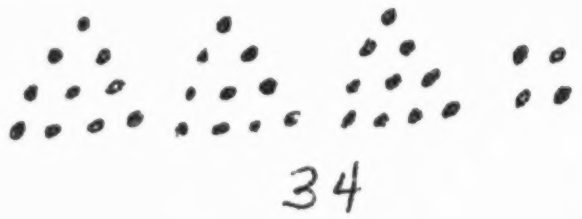
CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

children can see 3 sets of 10 and 4, and 4 sets of ten and 6.



Now observe that if all the objects that are not grouped by ten are put thogether, another set of ten will be formed to make 8 tens in all.

Write on the chalkboard:

$$34 + 46 = (30+40) + (4+6) = 70 + 10 = 80$$

$$\begin{array}{r} 34 \\ +46 \\ \hline \end{array} = \begin{array}{l} 30 + 4 \\ 40 + 6 \\ \hline \end{array} = \begin{array}{l} 70 \\ +10 \\ \hline 80 \end{array} = 80 = \begin{array}{r} 34 \\ 46 \\ \hline 80 \end{array}$$

70 +10

Following the understanding of this concept the children will be ready to do computation exercises such as:

$$\begin{array}{r} 27 \\ +13 \\ \hline \end{array} = \begin{array}{l} 20 + 7 \\ 10 + 3 \\ \hline 30 \end{array} + 10 = \begin{array}{r} 27 \\ +13 \\ \hline 10 \\ 30 \\ \hline 40 \end{array} = \begin{array}{r} 27 \\ +13 \\ \hline 40 \end{array}$$

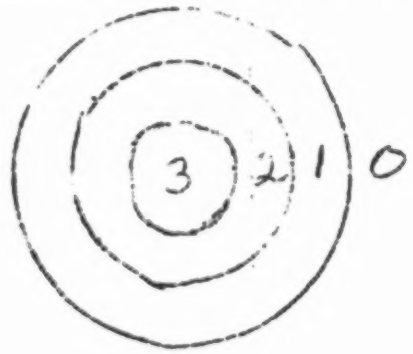
CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

Draw 3 circles on the blackboard.



Have a child stand an assigned distance from the board and throw a bean bag three times. Another child keeps score on the board. In keeping score the teacher directs the children to add from the top to the bottom The teacher keeps a record of every childs score. After the child has thrown the bean bag three times, he then becomes the scorekeeper for the next child up. The children rotate until every child has had a turn to throw and to be scorekeeper. The teacher then announces the winner and decides what bonus the winners receive.

Suggestions:

Star on their forehead!
Stamp on hand (if available)!
Do seatwork at the board, instead of their seat!
Be Math helpers for a day!
Wear winner hats!

After the children are familiar with adding from the top to bottom as in the bean bag game, the teacher will guide the children to apply their understanding of the commutative and associative properties to discover that he can start at the top or at the bottom.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND SUGGESTIONS

LEVEL II

12	48	36
+29	+26	+54
11	14	10
+30	+60	+80
41	74	90

After the children understand this method of carrying, the "short-cut" can be introduced. It can be done by presenting side by side the same problem worked in both methods. Have children go to the board and try both ways before doing it on paper.

38	38
+26	+26
14	64
+50	
64	

Explain that the ones number (4) stays in the ones column, while the tens number (1) goes in the tens column.

8. Columnar Addition

The child will be introduced to column addition as he works with three addends whose sums are not greater than eight.

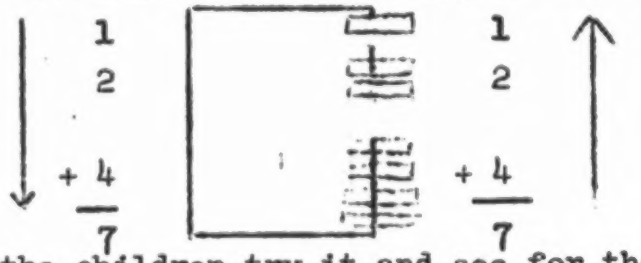
Keeping score in a game can be an effective way to introduce columnar addition.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

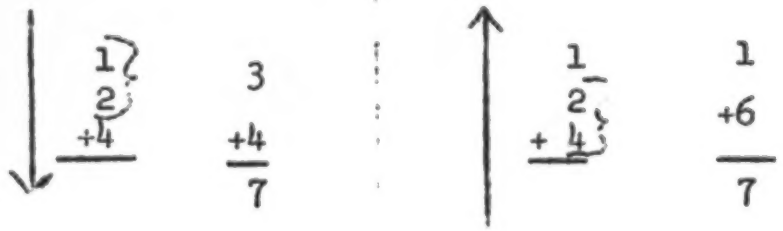
12. Addition Problems in Life Situations

LEVEL II

Again the clothespins and chipboard can be used:

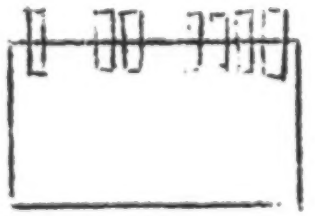


Have the children try it and see for themselves. Have them give the number combinations involved.

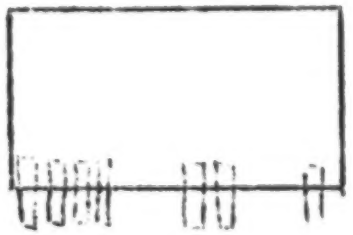


For the same three numerals to be added horizontally turn the card with the clothespins on the top and bottom.

1 + 2 + 4 = 7



(1+2) +4 = 7
3 +4 = 7



4 + 2 + 1 = 7
(4+2) + 1 = 7
6 + 1 = 7

As soon as the addition facts have been formally introduced, opportunities should be used when they arise (and they should be caused by the teacher to arise), to put this knowledge into the context of daily living.

Examples:
1) Count the children present each day.
2) Add the papers from each reading group.

CONTENT

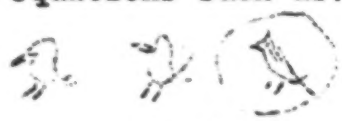
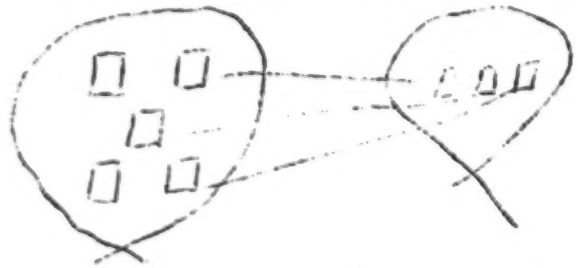
RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

3) Add the red and white stripes in the flag.
4) Add the number of children eating lunch with those not eating lunch.
5) Choose two girls with buttons on their dresses and add how many buttons they both have.
6) Add the number of chairs in one row with another row.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
B. SUBTRACTION		LEVEL II
1. Set Separation	Addison-Wesley Elementary School Math Book 1	Begin by exhibiting a set of five objects on the demonstration table or on a flannelboard. Ask the children how many are in the set. When they discover that there are five, remove two objects and hold them up for the children to see. Ask them how many objects you took away. When they respond "two", ask, How many are left? Now display the symbols 5-2. Read the equation as "Five take away two." After set demonstrations, invent some story problems involving the children in the room and situations involving "take away". Create problems such as the following: 1. Johnny has four pencils and he gives one each to the other children; how many pencils does Johnny have left? 2. There are five children working at the art table; three of them leave to join their reading group; how many children are left at the art table. Each time one of these stories is portrayed, exhibit the symbols for the subtraction combinations, such as 5-3, in both the equation form and the vertical form. To begin, the children should identify pictures that define take away without equations such as: 3 - 1 3 - 2 4 - 1

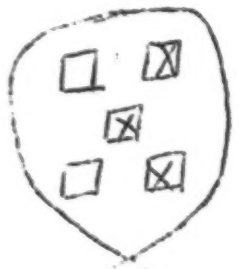
CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
2. As a Comparison of Sets		**LEVEL II** Following understanding of this concept they will be ready for equations such as:  3 - 1 = 2 This concept of how many more and how many less is difficult for mentally retarded children. Have the children work with manipulative materials (blocks, flannel pieces), popsicle sticks, etc.) to illustrate examples. Ask the children to make two sets with yarn. In one set put 5 blocks, in the other set put 3 sticks. Then ask, "Which set has more things?" "How many more?" With yarn, have them match one-to-one, then point out that two were unmatched. These two tell how many more.  5 - 3 = 2 The same example could be used to illustrate which set has less - how many less. The concept of Take Away is illustrated with one set in which some things of that set are removed. The concept of How many more or How many less is illustrated by using two sets and matching the things in the sets of the same quantity.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

3. Subtraction as Inverse of Addition

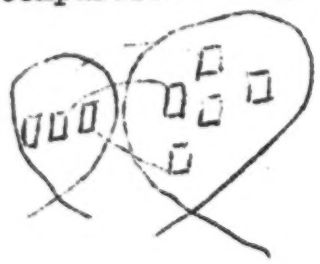
Take Away



5 - 3 = 2

$$\begin{array}{r} 5 \\ -3 \\ \hline 2 \end{array}$$

Comparison of Sets



5 - 3 = 2

$$\begin{array}{r} 5 \\ -3 \\ \hline 2 \end{array}$$

In general, this idea is easy for the children to grasp, since, by using sets, they can see that if they remove a certain number of objects and then return these objects, they have the same number they started with.

Give the children 5 manipulative materials. Ask them to take away 3 and tell how many are left. Write the process on the board $\begin{array}{r} 5 \\ -3 \\ \hline 2. \end{array}$

Then, tell them to look at the set, how many are still in the set ____ 2. Ask the children to put the 3 back and then how many are in the set. Write this on the board $\begin{array}{r} 2 \\ +3 \\ \hline 5. \end{array}$ Do the same with $\begin{array}{r} 4 \\ +1 \\ \hline \end{array}$ and $\begin{array}{r} 5 \\ +0 \\ \hline \end{array}$

Use classroom situations to help point out this concept. For example:

In counting the number of boys and girls each morning, the monitor should go to the board and write all the related facts that have the same numbers. At first this will take teacher guidance. If this

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

is done every day, the children will soon know how to do it by themselves.

7 boys	6 girls	13 children	13 children
+6 girls	+7 boys	-7 boys	-6 girls
13 children	13 children	6 girls	7 boys

After many practical situations they will be ready to do follow-up activities such as:

$$1 + 2 = 3$$
$$3 - 1 = 2$$

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

4. Subtraction with Mathematical Sentences

5. Regrouping or borrowing

LEVEL II

Children should have the understanding of numbers in relation to objects such as:

○ ○ ○ ○ ○ ○ ○	7-6= [1]
□ □ □ □ □ □ □	7-5= [2]
△ △ △ △ △ △ △	7-4= [3]

They should understand how to read mathematical sentences of pictures which are already marked as well as pictures where they have to mark the appropriate number taken away, such as:

✗ ✗ ✗ ✗ ✗ △ △	7-5=___

Other Exercises:

1) Make 6 . Color 4 red and 2 green

$\begin{array}{r} 6 \\ -4 \\ \hline 2 \end{array}$ $\begin{array}{r} 6 \\ -2 \\ \hline 4 \end{array}$

2) Make 7 's . Take away 3 $\begin{array}{r} 7 \\ -4 \\ \hline 3 \end{array}$

Borrowing is introduced following a thorough understanding of the tens and ones concept. To begin, have the children use the number line to answer problems such as:

15-7=[8] $\begin{array}{r} 15 \\ -7 \\ \hline 8 \end{array}$ $\begin{array}{r} 25 \\ -7 \\ \hline 18 \end{array}$

25-7=[18]

CONTENT

RESOURCE MATERIAL

Addison-Wesley
Book 2
Unit 14

LEVEL II

One lesson should be spent on using the number line to get the answers to facts involving borrowing. Some children may notice, or the teacher can present this situation, that if 25-7 is to be done in this manner:

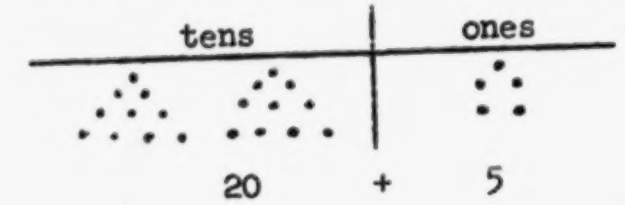
tens	ones
2	5
-	7
1	8

it will not work. How can seven from five have an answer of eight? How can 2 take away 0 have an answer of 1?

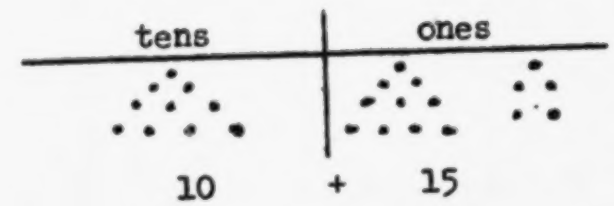
At this point, illustrate to the children with concrete materials how ten things can be borrowed from the tens column and used in the ones column.

Write the corresponding numerals on the board.

Step ①



Step ②



Several lessons may need to be spent on how the numbers change when ten are borrowed from the tens column and put in the ones column, such as:

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

Regrouping or borrowing (cont.)

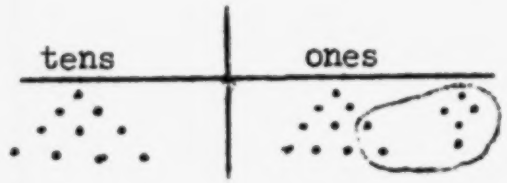
LEVEL II

40 + 8 = 30 + 18

50 + 3 = 40 + 13

80 + 5 = 70 + 15

When the children thoroughly understand what it means to change 20 + 5 to 10 + 15, they are ready for Step 3, that is, subtracting by borrowing



Step ③

25	20 + 5	10 + 15	25
-7	- 7	- 7	-7
		10 + 8	18

Point out to the children that in order to take away seven dots, one set of ten was broken. That is, they must think about taking seven from fifteen rather than seven from five.

If Step 3 is thoroughly understood, Step 4 will be easy. Parentheses should be used around the bottom number to remind the children that both numbers are to be subtracted. Some children may also need to have it explained to them that borrowing is only done with the top number. The bottom number stays the same.

Step				
④	42	40 + 2	30 + 12	42
	-15	-(10 + 5)	-(10 + 5)	-15
			20 + 7	27

CONTENT

Regrouping or borrowing (cont.)

RESOURCE MATERIAL

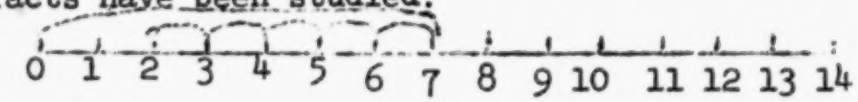
SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

Following understanding of this, the children will be ready for the short-cut way of borrowing. Most of the children will find it helpful to cross out the tens digit and write the new digit beside it, placing the one above the ones digit to remind them of the regrouping involved.

Step 5

$$\begin{array}{r} {}^{3}\not{4}2 \\ -\ 1\ 5 \\ \hline \end{array}$$

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
6. Use of the Number Line		**LEVEL II** Follow the same procedure as described under "Using the Number Line for Addition.", except instead of stepping forward to a larger numeral, the child will step backward to a smaller numeral. Example: Ask a child to stand beside 0 and take 12 steps forward. Write the numeral 12 on the board. Now direct him to take 5 steps backward. Have the children participate in counting the steps to be sure that he moves back 5 spaces. Write the numeral 5 beside the 12 leaving enough space for an operation sign. Ask the children whether this describes "adding" or "take away". When they agree that it describes "take away" write the minus sign between the 5 and the 12 and have the children give you the answer. Observe that the child is standing beside the "7" square. Continue this activity for enough examples until the children understand it. Following this, draw a line about 6 feet long on the chalkboard. Beginning at the left end, place 21 dots evenly spaced along the line. Label the dots from 0 to 20. Tell the children that instead of playing the stepping stone game, they are going to play a similar game on the chalkboard, using a number line. Indicate to them that they should think about the dots on the number line as stepping stones. Now, have the children participate in such subtraction activities as 7-5; 6-3 or whatever facts have been studied.  7 - 5 = 2 $\quad\quad$ $\begin{array}{r} 7 \\ -5 \\ \hline 2 \end{array}$ Seatwork problems similar to the above can be given for the children to work on independently after they understand what was done on the floor and on the board.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUE AND ACTIVITIES
7. Subtraction of Two-Place Numbers (a) Two-Place Numbers (Without Borrowing)	SRA - 1	**LEVEL II** With problems such as $\begin{array}{r} 13 \\ -2, \end{array}$ $\begin{array}{r} 16 \\ -4 \end{array}$ $\begin{array}{r} 18 \\ -3 \end{array}$ the quickest and easiest way to answer them is as illustrated: Tens | Ones 1 | 3 - | 2 1 | 1 The important idea for them to keep in mind is the correct placement of the numerals representing the ones and the tens. Write the following placeholder facts on the chalkboard and have the children complete them: $\begin{array}{r} 2 \\ +\square \\ \hline 6 \end{array}$ $\begin{array}{r} 12 \\ +\square \\ \hline 16 \end{array}$ | $\begin{array}{r} \square \\ +3 \\ \hline 5 \end{array}$ $\begin{array}{r} \square \\ +13 \\ \hline 15 \end{array}$ | $\begin{array}{r} \square \\ -3 \\ \hline 1 \end{array}$ $\begin{array}{r} \square \\ -3 \\ \hline 11 \end{array}$ | $\begin{array}{r} 9 \\ -\square \\ \hline 6 \end{array}$ $\begin{array}{r} 19 \\ -\square \\ \hline 16 \end{array}$ Guide the class to an awareness of the relation between the two facts in each pair. Help them realize that knowing how to work the problems involving only ones will help them to work problems involving tens and ones. Remind them to do the problems with two-digit numerals by first adding or subtracting ones, then putting this sum or difference with the tens to get the answer. Write a series of vertical-notation subtraction problems on the chalkboard. Have the children copy these on sheets of paper and work each problem in turn, reminding them to line up the ones and tens carefully. $\begin{array}{r} 5 \\ -3 \\ \hline \end{array}$ $\begin{array}{r} 15 \\ -3 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ -4 \\ \hline \end{array}$ $\begin{array}{r} 19 \\ -4 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ -3 \\ \hline \end{array}$ $\begin{array}{r} 17 \\ -3 \\ \hline \end{array}$ $\begin{array}{r} 6 \\ -5 \\ \hline \end{array}$ $\begin{array}{r} 16 \\ -5 \\ \hline \end{array}$ Children will catch on to the "quick and easy" method of subtracting two-digit numbers without too much difficulty,

CONTENT

RESOURCE MATERIAL

[illegible] ACTIVITIES

LEVEL II

(b) Three-Place and Four-Place Numbers

however, they should be introduced to subtracting with expanded notation to prepare them for borrowing.

Before children are given problems using expanded notation, they should be given a list of numerals and asked to write these numerals in expanded notation such as:

On board:

85	78
36	97
42	18

On paper:

85 = 80+5	78 = 70+8
36 = 30+6	97 = 90+7
42 = 40+2	18 = 10+8

When the children understand expanded notation, give them a list of problems and ask them to do them in expanded notation. Give them problems involving no borrowing such as:

On board:

84	76	99
-32	-25	-64

On paper:

80+4	70+6	90+9
-30+2	-20+5	-60+4

The same can be done with three and four digit subtraction.

On board:

841	7654
-321	-2531

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

On paper:

$$\begin{array}{r} 800+40+1 \\ -300+20+1 \\ \hline \end{array} \qquad \begin{array}{r} 7000+600+50+4 \\ -2000+500+30+1 \\ \hline \end{array}$$

After understanding of expanded notation, children can have more drill on the "quick and easy" method of subtracting two and three digit numerals.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
11. Subtraction Problems in Life Situations		**LEVEL II** Use classroom situations to illustrate subtraction: Use number line wherever possible. 1) Have one child each day go to the board and show by subtraction how many are absent. (Take away) 2) Figure out how many more boys than girls. (Comparison of sets) 3) How many more books than children in a reading group. (Comparison of sets) 4) How many days are left in this month? (Take away) 5) How many days are left in this week? How many have gone by? (Take away) 6) How many more chairs than children? 7) How many more children than room jobs available?

PRACTICAL APPLICATION OF QUANTITATIVE ABILITIES

Section IV

Level II

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL 2
IV PRACTICAL APPLICATION OF QUANTITATIVE ABILITIES A. TIME 1. Awareness of Time a. Calendar	Arithmetic Curriculum for the Mentally Handicapped Sisters of St. Francis of Assisi, Cardinal Stritch College, Milwaukee, Wisconsin. 1960	A daily calendar discussion period helps the child to place himself in the milieu of time. A calendar that can be built up day by day is valuable for mastering the relationship between the terms yesterday, today and tomorrow and the names of the days of the week. If this practice is continued over several months, the child should have adequate readiness to learn the sequence of the days of the week. This skill is verbal; the child is not expected to read the names of the days. Daily calendar discussions should also include mention of the season and how it appears in nature, as well as the name of the month and year. Calendar discussions should also stress birthdays as a motivation for the child's learning his own age. He should be asked frequently how old he is. At this level he is expected to give the correct response. Conversational references should be made to the clock and its purpose as a time-telling instrument.
2. Telling Time	Large Clock for demonstration. Individual clocks made from tag board.	Readiness for learning to tell time on the hour is probably present at this level if introduced to at previous level. Rapid check is made that the child can read the numbers on the clock face and can discriminate and name the long hand and the short hand. A large clock face with no hands is drawn on the blackboard by the teacher. She points out that the 12 is always on top. Drawing the long hand she explains that when the long hand points to 12 it is saying o'clock. She points out, but does not emphasize, that another name for the long hand is the minute hand. Then drawing the short hand to any number of 1, 6, or 11, the teacher explains that the short hand tells which o'clock it is. She also mentions that this hand, too,

CONTENT

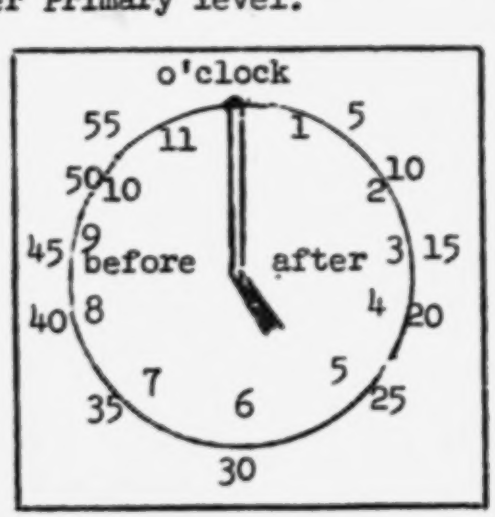
RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUE AND ACTIVITIES

has another name. It is called the hour hand. Using a real clock with a large dial, she demonstrates that the long hand goes all the way around the face of the clock in the same amount of time that it takes the short hand to get from just one number to another. This period of time is called an hour. The teacher explains that an hour is not as long as a day, but she enumerates the activities carried on within the classroom in an hour's time.

Practice periods are devoted to reading the clock in telling time on the hour with 12 o'clock being presented last. When this step has been mastered the child can be asked to move the hands on the clock, or draw them, to tell a designated time.

After the concept of half has been developed, telling time on the half hour is introduced, but mastery is not required on the Upper Primary level.



A clock constructed in this manner can be very helpful. The numbers 5 to 55 and the word o'clock as well as the minute hand should be one color such as red. The numbers 1 to 12 as well as the hour hand should be another color such as black. As an aid to saying the time, it is also helpful to paint one-half of the clock one color such as yellow. Write the words after and before on the appropriate sides.

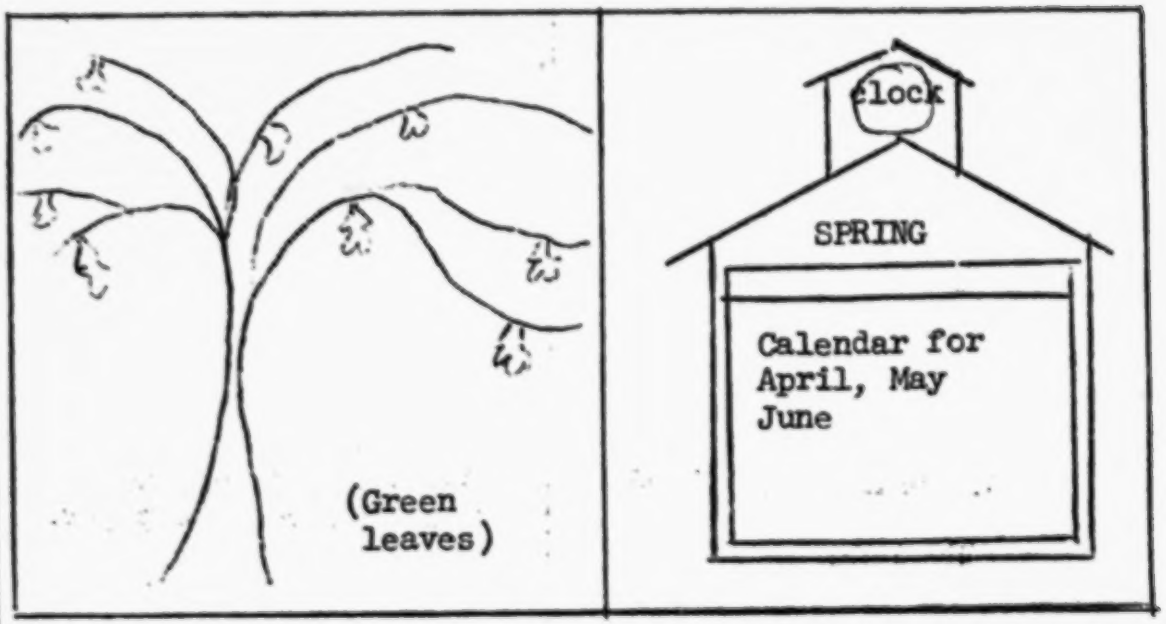
The teacher illustrates with a blackboard drawing that the long hand has gone half way around the face of the

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		clock, and that the short hand has gone half way to the next number. The time is read as half-past. Conversational acquaintance is given to the terms hour and minutes, as well as to some concept of their relative duration. The teacher might ask the children to sit silently for one minute; or to engage in some simple repetitive activity for one minute or she might assign a rather lengthy task (art work, perhaps) then stop the children at the end of a minute and again at the end of an hour. Discussion is then held of the relative lengths of time.
3. Using the Calendar	All items can be made from construction paper.	Below is a suggested bulletin board to accompany calendar and time teaching. It can be kept up all year with a few monthly and seasonal changes. Circle date and add construction paper, star for birthdays.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES



Sequence of the days of the week and their relation to today, tomorrow and yesterday can be reviewed daily in an interesting manner through use of a bulletin board arranged with comments on personal interest news of the week. Practice in reading the names of the days of the week and the concept of a week is provided when each item is clearly dated and children are guided in interpreting these bulletins in terms of calendar reading. The fact that a week is usually a line of days across the calendar is useful in demonstrating the relative length of a day and a week.

Daily discussions are continued on this level of the seasons and how their passing is reflected in nature and in the temperature, the names of the months and the year. A simple idea of the relative lengths of a day, week, month, season and year is developed very gradually through these discussions.

Children should be made aware of the months having different number of days. A finger game can make this easy to remember for those who have memorized the sequence of the months.

CONTENT

4. Relating Time to Life Situations

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

All the finger tips have 31 days, and between the fingers have 30 days except for February which will need to be explained.

The concepts of faster and slower are introduced in situations requiring the child to make a judgement as to which object is traveling faster or slower, records, drums, P.E., tortoise and hare, snail crawling.

Although children on this level are not expected to retain the term speedometer, an acquaintance with its use is introduced. A short trip on the school bus might be utilized to point out the movement of the recording device as an indication of going faster or slower.

The child is taught to give his correct age and birthday, and to find his birthday on the calendar.

The concepts of faster and slower and, in a very simple way, of miles an hour and acquaintance with the appearance and use of a speedometer are developed in situations where the child can make a judgment concerning grossly varying speeds.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL II
B. MONEY		
3. Relative Value	Pennies, nickels	Genuine coins should be used in teaching money to the retarded child. Pennies are first presented and the child counts them to ten cents. The concept that pennies and cents are interchangeable terms is presented and firmly established before any further instruction is attempted. The cent sign is introduced and the child practices reading and writing "¢". After a period of assimilation has been allowed, recognition of the nickel is introduced. It may prove helpful to use a package of gum to illustrate the equivalence of five pennies to a nickel. One end of the package is opened completely and the child counts the five loose sticks. He is then led to form the conclusion that five loose sticks of gum and a package of gum are the same amount of gum, and that, therefore, five pennies (the loose sticks) are the same as the package (the nickel). The child learns to read penny and nickel on this level. A brief review of counting, beginning with a grouping of five might prove helpful as a readiness for teaching the counting of a nickel and pennies to ten cents. The relative purchasing power of a nickel as contrasted to a penny can be illustrated by using charts on which are mounted objects such as penny lollipops and nickel lollipops, erasers, or other small articles. The concept of change-making for a nickel can also be presented through the use of gum (or any articles commonly sold for a penny).

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL II
	Dimes	The child learns that sometimes the clerk returns some money and that this money is called change. After the child is able to handle a nickel and pennies to the amount of ten cents, the dime is presented as the equivalent amount of money. After the tens and ones concept has been presented, counting a dime and pennies to twenty cents might be introduced as a teacher directed activity. The child is reminded that two dimes are two tens; two tens and no ones are 20; two dimes are 20¢.
4. Value of coin combinations	Construction paper cut in strips or short pipe cleaners	Ask the children to make a chain with paper strips or pipe cleaners, which shows how many cents are in a nickel. Then ask them to do the same by showing how many cents are in a dime. If the two chains are pasted or linked together, the children will see how a nickel and a dime make 15 cents, just as 5 links and 10 links make 15 links. More mature children may be able to continue this activity to illustrate the value of a quarter, a half dollar, and a dollar. When these chains have been completed, hang them on a bulletin board and have the children match the value of coins to the number of links. This same technique should be used to illustrate the different combinations they could use to make the right amount needed to purchase their school lunches. Instruction in the proper handling of money should correlate throughout its study. Children are taught to be careful, to keep money in a safe place (bank, purse, billfold, special box) to respect the ownership rights of others, to save for desired articles, and to develop simple judgments regarding the comparative costs of articles. Some children also need to understand that money does not buy friendship as they sometimes think it does. Frequent shopping experiences in a classroom store and occasional teacher-

CONTENT

C. LINEAR MEASUREMENT

3. Tools and units
& of
4. Measurement

a. Ruler

b. Inches

RESOURCE MATERIAL

Elementary School Math. - Teachers' Edition
P. 204 - Bk. 1

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

directed trips to real stores serve well as illustrative situations of money handling.

The most important mathematical concept to convey is that the choice of a unit of measurement is arbitrary. Basically, there are two things involved in measurement: the choice of a unit and counting. The children are familiar with counting. The thing that remains is to introduce the idea of selecting a unit of measurement.

That different units can be used for measurement is presented to children by having them compare heights of objects, first using a stack of blocks as the unit and then using a ruler, (paper, hands, steps, etc., can be used instead of blocks).

The book is as tall as ____ blocks.
The flower is as tall as ____ blocks.
(etc.)

Children should begin with rulers having only inch markings. Homemade cardboard rulers will suffice. The children are guided in handling the ruler, using the term, and in observing the number sequence of the markings. The teacher explains that the numbers mark off the inches and asks them to find the 5 inch mark, the 10 inch mark, etc.

CONTENT

c. Foot

d. Yardstick

e. Tape Measure

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

She emphasizes that 12 is the last number found on the ruler because a ruler is 12 inches long and another word for 12 inches is a foot.

Practice should be given in rough estimates of about a foot, about one inch, or 6 inches, etc. Then, with the help of the teacher, the children practice measuring all possible objects around the room. The necessity of matching the end of the ruler and the edge of the object being measured must be emphasized repeatedly.

Ask whether some child can think how to measure the length of a table using only one ruler. help the children see that they can mark where the end of the ruler falls, pick up the ruler, and begin measuring again from the mark. Provide them with plenty of practice measuring objects around the room, each using only one ruler.

If the children find that a table is three feet long, the "short-cut" measuring device can be introduced. Replace the measured 3 feet with the yardstick. The term yard and its relationship with the yardstick should be used conversationally. Feet as the plural of foot may need to be explained to the less mature.

The tape measure could also be introduced as a short-cut device for measuring longer distances, as from ceiling to floor, or long cupboards. For most classes, it will be preferable to use only instruments which are marked off in inches and feet.

The next step is instruction in drawing lines to specified lengths. Left-handed children frequently experience difficulty in handling a ruler unless adaptation is made. It might prove helpful

CONTENT

RESOURCE MATERIAL

strip of tagboard

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

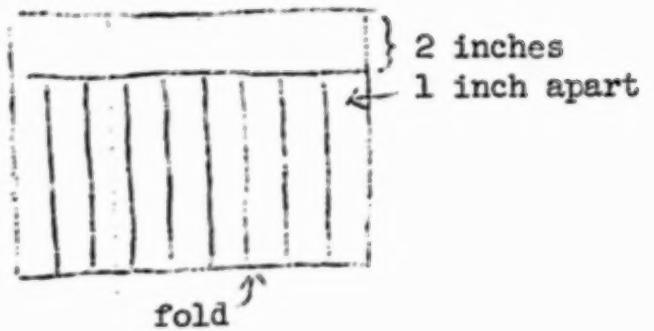
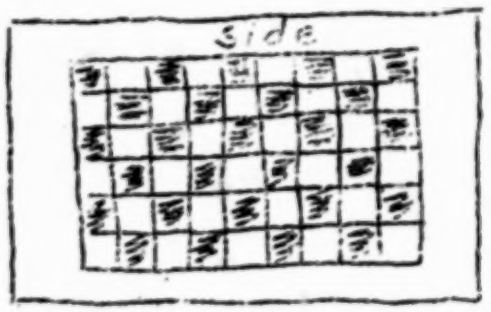
to show the child how to hold the ruler upside down and draw the line from the desired inch marking to the end of the ruler in a left to right movement. An important step in learning to draw a line is that of how to hold the pencil so that it moves firmly along the edge of the ruler. The teacher accompanies her oral presentation by placing the written form of the measuring on the board. A giant ruler made from tagboard is very helpful for illustration purposes. Practice should be given in reading and writing the terms: inch, inches, and foot.

After the concept of half of a whole has been presented, the teacher returns to instruction on the use of the ruler, extending it to introduction of the concept of half-inch. One or two lessons might be devoted to reading the half-inch mark on the ruler and to measuring objects to the half-inch. Mastery is not expected for the less mature.

The terms inch and foot should be integrated in review of conversational use of the terms: long, longer, longest, short, shorter, shortest. Too long and not long enough.

Width as the second dimension of two-dimensional figures is introduced appropriately when the term rectangle is presented. Terms introduced through the use of concrete objects (boxes, desks, tables, books, etc.) are: wide, narrow, too wide, widest, too narrow, not wide enough. Vocabulary development might well serve as the specific objective of a few lessons in using the ruler. The terms deep, deeper, deepest, are probably best illustrated by liquids.

Conversational use of the terms: near, far, farther, and miles is gradually refined to the

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL II
		ability to compare two distances, both of which are less than a mile. The concept of speed would advisedly be correlated with that of miles in enriching conversational use of the term miles an hour, or miles per hour.
5. Use of linear measurement in life situations	Two (different colors) construction paper per child. Cut one of these papers in 1" by 12" strips.	Make place mats. Have the children measure where to cut. Procedure: 1. Fold the construction paper in half. 2. Measure as illustrated:  3. Cut from fold to 2-inch line. 4. Open and weave strips from side to side: 5.  If rolled and sides pasted together, the same pattern can make a bird cage or a chinese lantern. Have the children make margins on their daily writing papers. Have the margins be different

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL II
		widths each day. Measure the growth of a plant in the room. Compare the length of several girls' hair.
D. LIQUID & DRY MEASUREMENT 1. Recognition		Recognition of cup, pint, quart, half gallon, gallon, teaspoon, and tablespoon should begin with a conversation involving these measurements. Containers which measure each of these quantities should be available. If they are not available, children could be asked to bring containers from home such as milk cartons, cans, bottles, jars.
2. Units of measurement a. Cup	large container water measuring cup dinner cups milk cartons ½ pt. pint ½ quart quart ½ gallon cans jars bottles	Begin teaching with the cup which is most familiar to the children. Have available a large container with colored liquid (sprinkle a bit of tempera paint in water). Use a measuring cup to fill a variety of containers to see how many cups will fill the containers. Have some dinner cups among the containers and help the children realize that dinner cups are not always an accurate measurement of a cup. Help the children become aware of the fact that one cup fills one of their lunch milk cartons. When they understand this, the word pint can be introduced, - that 2 cups measure a pint, but only one cup measures ½ pint.
b. Pint		If possible, have a ½ pt. milk carton, and a pint container available for each child and give each child practice in measuring. When the children are ready, introduce the quart, ½ gallon and gallon and use them in the same manner. Each child should have many opportunities
c. Quart d. ½ gallon, gallon		

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL II
		to manipulate these different sized containers. As a seatwork activity, children could draw or cut from magazines, pictures of things that can be bought in pint, quart, etc., containers.
		Some child may notice 8 oz. on a measuring cup and wonder what it means. They should not be expected to remember the word ounces or that a cup holds eight ounces. It is another way to tell how much liquid a container holds. Have the children look on labels of cans and tell how many oz. that container holds and whether it is more or less than 8 oz. as is in a cup.
e. Teaspoons & tablespoons		Similar techniques can be used to help children become familiar with teaspoons and tablespoons. Help them realize the difference between measuring spoons and dinner spoons. Fine sand, as a dry measure, could be used to help them practice using measuring spoons. Colored water could be used for a liquid measure. To help the children remember which is which, ask them which is larger, a table or a tea bag? They will easily understand, just as a table is larger than a tea bag, a tablespoon is larger than a teaspoon.
4. Use of liquid & dry measure in life situations		1. Plan a party and help the children measure the correct amount of water to make lemonade, or gelatin, or pudding. 2. Have the children measure the water needed to mix with the paints. 3. Find some simple recipes and have children make them. Suggestions: scrambled eggs — hot chocolate french toast — box mixes hot cereal — simple sandwiches

CONTENT

E. WEIGHT

1. Pounds, ounces, etc.

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

The use of the scale as an instrument for measuring weight is developed. The terms heavier and lighter are introduced by directing the child to lift objects that are grossly different in weight. The different types of scales commonly used in the home and grocery store should be brought to the classroom. The child is asked to speculate on what type of scale would be suitable for weighing various things. During the weighing process, the terms pounds is introduced conversationally. Discussion periods should be devoted to things ordinarily bought by the pound. A trip to the grocery store to observe various objects being weighed, and packages marked according to weight, would provide necessary conceptual background. During instructional periods centering on the weight concept, the teacher guides the children in ascertaining who weighs more, who is heavier, who weighs less, who is lighter. A bathroom scale with an easily read indicator should be used and children guided to read their weight to the nearest decade number (a little more than 70 pounds, etc.) The term heaviest is introduced through use of objects having fairly gross differences in weight.

Acquaintance with how a butcher's scale, basket scale and household scale are read can be provided by an experience trip to a super market. Which articles are marked as to their weight is also pointed out. Pounds of butter or other goods packaged in even pounds can be used in the classroom to provide practice in weighing, in reading a scale, and in comparing weights. The term ounce as being a quantity much lighter than a pound is introduced. It should be pointed out that ounces are a measurement of liquids as well as solids.

The word tons is used conversationally in speaking of trucks, empty or with big loads.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

F. SPEED

2. Comparative speeds & miles per hr.

G. GEOMETRIC FORMS

1. Recognition and relationships

LEVEL II

The concepts of faster and slower and, in a very simple way, of miles an hour and acquaintance with the appearance and use of a speedometer are developed in situations where the child can make a judgment concerning grossly varying speeds. For example, which is faster:

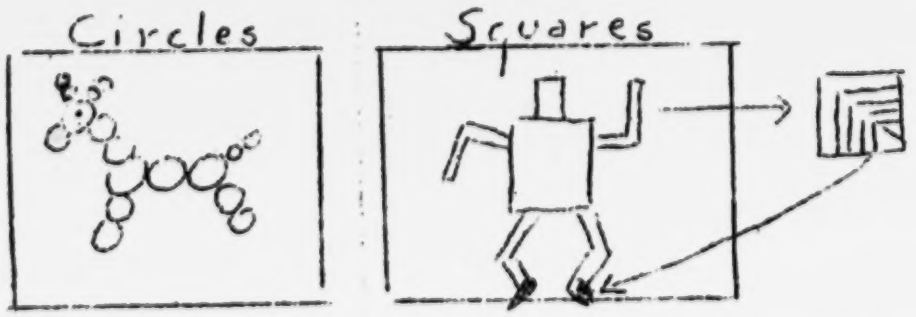
airplane or car?
bicycle or car?
train or airplane?

Some of the children may understand the comparison between different speeds of a phonograph and the speedometer. Reading a speedometer to the nearest decade number is introduced. A bicycle speedometer may be used for instructional purposes.

Children should have many experiences in recognizing and drawing the geometric forms.

When they recognize them, have them bring to school or draw things that are round, such as lids, money, boxes. The same can be done with squares, rectangles and triangles.

Art pictures can be made with geometric shapes:



CONTENT

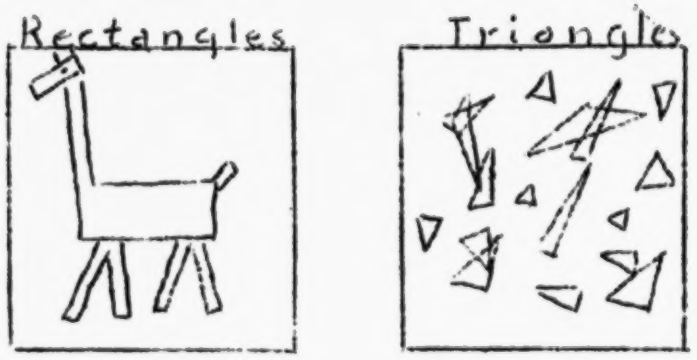
RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

H. TEMPERATURE

1. Reading the Thermometer



Cut out triangles of various shapes and colors and arrange in scattered arrangement.

Temperature terms: thermometer, temperature, hot, cold, warm, cool, warmer, cooler, are used conversationally in discussion of the weather. If the thermometer used has the decade numbers clearly marked, the child can be introduced to temperature reading by learning to tell that temperature is a little more than, or a little less than or around the various decade numbers. The term degrees is introduced orally and in writing. Reading the degrees symbol (°) is also introduced.

Televised or broadcast weather reports should be analyzed in the classroom and the more common terms explained. Increasing cloudiness, fair, clearing, clear, high winds, freezing, foggy, and the like, when discussed on the day described, becomes a meaningful learning experience.

Brief review of counting by 2's precedes introduction to exact reading of the thermometer. After practice in reading the thermometer to exact degrees has been mastered as a blackboard exercise, another period is devoted to reading a real thermometer.

CONTENT

I. PROBLEM SOLVING DEVICES

1. Translating real situations into workable, mathematical problems

2. Memory techniques

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL II

The teacher might provide a bowl of hot water and one of ice cubes, so that the temperature readings will vary perceptibly. Discuss ways in which thermometer is used, i.e., measuring fever of people, measuring when a roast is finished, etc.

Children should be given many experiences in which to use counting, money, and measurement. Examples:

Make simple recipes and have the children do the measuring.

Pretend to give each child $1.00 and give each one a page of ads and have them cut out as many things as they could buy for that amount.

Have the children count how many chairs will be needed for each reading group and how many to take out when someone is absent. How many papers will be needed?

LEVEL III

DEVELOPING A VOCABULARY OF QUANTITATIVE TERMS

Section I

Level III

VOCABULARY - LEVEL III

C. TERMS RELATED TO MATHEMATICAL PROCESSES

angle - a figure formed by two rays with a common endpoint. (A ray is part of a line. It has one endpoint and infinite length in one direction.)

average - a single number which represents a set of numbers. The most common average, the arithmetic mean, is found by dividing the numbers into their sum.

base - (of a geometric figure) - a segment which is part of the figure, usually at the bottom and usually vertical.

clockwise - moving in the same direction as the hands of a clock.

compute - to perform the indicated arithmetical operations.

cone - a solid formed by rotating a right triangle about one of its legs. The other leg determines the base and the hypotenuse determines the slant height. (Suggested by an ice cream cone)

counter clockwise - moving in the opposite direction from the direction in which the hands of a clock move.

cube - a solid with six equal square faces.

cylinder - a figure made by rotating a rectangle around one of its bases. (Example, a tin can.)

decimal - a fraction that has a power of ten for the denominator, as $\frac{3}{10}$, $\frac{24}{100}$, $\frac{17}{1000}$. The denominator need not be written if the fraction is expressed with a decimal point and place value. $\frac{3}{10} = .3$, $\frac{24}{100} = .24$, $\frac{17}{1000} = /017$.

decimal point - a dot written between numerals to separate the whole number part of the numeral from the fraction part.

denominator - the part of a fraction that is the number dividing the other number. In common fractions it is written below the numerator. In decimal fractions it is read from the number of places to the right of the decimal point.

VOCABULARY - LEVEL III

C. TERMS RELATED TO ... (Cont'd)

depreciate - to lose value.

diameter - a line segment extending from one point on the circle segment the center to a point on the opposite side of the circle.

elevation - the measured height of a point with reference to the base.

equal in measure - two measurement devices that measure the same amount as, "2 feet is equal in measure to 2/3 yard." Written m

2 pints ⩵ 4 cups

exterior - on the outside, usually used to indicate a point which is not within a simple closed curve, and not on the curve. Also used for angles.

intersect, intersection - the set of points that two geometric figures or two sets have in common.

latitude - distance measured in degrees north and south from the equator along the arc of the great circle through the poles.

metric system - a system of measurement based upon the decimal system of numbers.

parenthesis () - Symbols used to enclose numerals and operations to indicate that the quantities should be considered together.

per cent - hundredths. A fractional number with a denominator of 100.

perpendicular - two lines are perpendicular if, and only if, the angles that they make when they intersect are all four equal. (Right angles)

place value - the value given to a digit because of its place in the numeral. In the numeral 37 the face value of the 3 is less than the face value of the 7, but the place value of the 3 is 10, and the place value of the 7 is only one. Face value is multiplied by place value to determine the value of the numeral.

527 = (5 X 100*) + (2 X 10*) + (7 X 1*)

Place values are marked with astericks.

VOCABULARY - LEVEL III

C. TERMS RELATED TO ... (Cont'd)

proportion - an equality of ratios or a relationship among quantities such that the quotient of the first divided by the second is equal to the quotient of the third divided by the fourth.

quantity - value, number amount. Any expression related to value rather than to form and relations.

quotient - the answer in division.

radius - a line from the center of a circle to any point on its circumference.

rate - amount charged per unit of some other quantity, as in the rate of interest; the quantity or degree of something measured per unit of something else as in rate of speed, or the birth rate: a ratio or proportion as the rate of exchange.

round off - representing the measure of any quantity only to a specified degree of accuracy.

take away - a colloquialism used to indicate subtraction. The term fits some word problems that infer removal of some elements, as, "If you had 7 toys and you take 4 of them away, how many toys would you have then." The term does not fit comparative subtraction problems, as, "John has 4 books, and Mary has 7 books. How many more books does Mary have?"

N U M E R A T I O N

Section II

Level III

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL III
I. NUMERATION C. NUMERAL RELATIONSHIPS 1. Understanding Numbers to Base 10	Arithmetic Curriculum for the Mentally Handicapped By Sisters of St. Francis of Assisi	Through the use of stick bundles, the concept of tens and ones and its extension to hundreds is reviewed. The teacher can introduce the concept of thousand by relating it to the cost of a piece of equipment or article being installed in a familiar building. The child builds the concept of thousand by bundling ones to tens; tens to hundreds. The ten bundles of one hundred each are counted by hunderds and the counting is recorded on the blackboard in a vertical column. When the thousand sticks have been combined and recorded, children are guided to observe that writing 1,000 involves another (a fourth) place value. The sticks are unbundled and piled loosely to give the children an idea of the bulk involved. The relationship between dollars and hundereds, ten dollars and a thousand is pointed out.
2. Counting Over 100	B. A. Sueltz, "Counting Devices and Their Uses." The Arithmetic Teacher, Feb. 1954, 1:25-30	Descirption of teacher-made Abacus. Counters with square rods are recommended.

CONTENT

RESOURCE MATERIAL

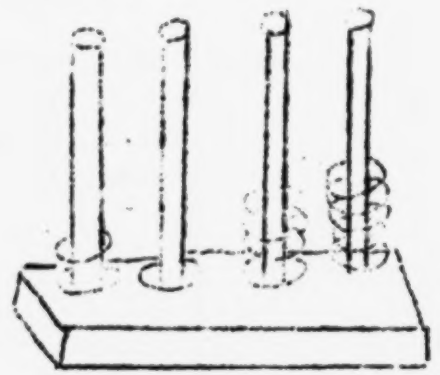
L. A. Mayer,
"The Scarabus or Scarsdale Abacus"
The Arithmetic Teacher,
Dec. 1955, 2:159

Discovering Meanings, Etc.
By Grossnickle & Brueckner
Pg. 67

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

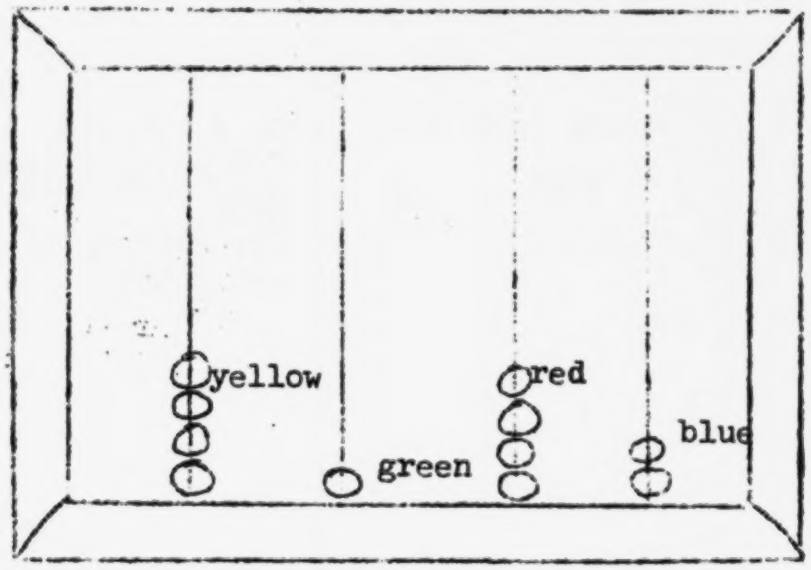
LEVEL III

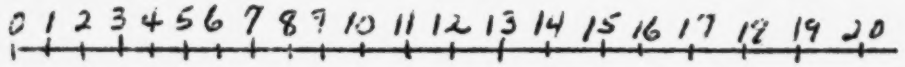
Ivory crochet rings are recommended as counter and cylindrical dowels.



This can be used in games as counting teams as in a spelling bee.

The use of different colors of the beads should help the pupil discover the relationship between the values of any two consecutive places on the abacus.



CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL III
2. Cardinal Numbers: Sequence & Relationships	Supples & McKnight "Sets and Numbers" The Arithmetic Teacher, Oct. 1961 8:281-286	Using Number Line to teach sequence and number  1. Read the numbers on the line by counting by ones from 1 to the right. 2. Count back from 20 to 0. 3. Which number comes after 10? 4. Select different numbers and ask which is more. 5. Use number line and after selection of different numbers, ask which is less. 6. Count by two's beginning with 2. 7. Count back by two's beginning with 14. 8. Telling whether one number is larger than another. After Before Between 7 ___ ___10 17 ___ 19 11 ___ ___20 29 ___ 31 20 ___ ___39 40 ___ 42
3. Ordinal Numbers in Practical Situations	Making Arithmetic Meaningful By Brueckner & Grossnickle Pg. 182-3	Ordinal Number explained by "which one". Some examples: (answer with an ordinal number) 1. Which one is your house? 2. Which classroom is yours? 3. What grade are you in? 4. Dinner is the ____ meal of the day. 5. Learning terms i.e., first, second, third, etc.
	Discovering Meanings in Elementary School Math By Grossnickle & Brueckner Pg. 94	Finding dates on a calendar Ask class "What day is today?" What day was yesterday? What day is tomorrow?

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
		Locating pages in a book Doing research for project. Finding page assignment.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
E. READING AND WRITING NUMERALS	"Arithmetic Curriculum for the Mentally Handicapped" - Sisters of St. Francis of Assisi	**LEVEL III** After a review of reading, writing and serial order of numbers to 1000, enrichment of the skill includes reading house and telephone numbers, and also the numbers on license plates. Zero is read as 0; four place numbers are grouped in reading, 1822 as eighteen twenty-two. Use of the zip code numbers in addressing envelopes is stressed. Newspaper and magazine accounts, social studies and science lessons which deal with large numbers are utilized in introducing the child to five- to nine-place numbers.
Roman Numerals	ibid.	Introduction to reading and writing Roman numerals to twelve is made as an aspect of time telling, namely that of reading Roman numerals on a clock face. The teacher presents two large clock faces, real or pictured, one having arabic, the other Roman numbers. Children are challenged to read the Roman clock face with the aid of comparison with the Arabic. The underlying system of Roman numeration is explained and reading and writing of Roman numerals is practiced for mastery. The teacher also points out to the children other uses for the numerals, as chapter numbers in books, date markings on cornerstones of buildings, etc.

CONTENT

Fractions

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

Introduce the terms numerator and denominator. Explain that the numerator is represented by the top numeral in the fraction and the denominator is the number represented by the bottom numeral of the fraction.

Explain that the numerator names how many and the denominator names the fraction. Thus, for 3/4, the four means fourth and the three tells how many fourths.

The class may gain additional experience in working with sets of equivalent fractions. It is suggested that students be presented the set (1/4, 2/8, 3/12, etc.) and have the students demonstrate how to find the next five or six fractions in this set. Their demonstration should include the breaking apart of the humerator and denominator to see how the additional fractions are found. For example, for 2/8 they would show:

$$\frac{2 \times 1}{2 \times 4}$$

and for 3/12:

$$\frac{3 \times 1}{3 \times 4}$$

Then, for the next fraction, the student should show:

$$\frac{4 \times 1}{4 \times 4}$$

and observe that this next fraction in his set is 4/16.

The use of a diagram to illustrate the equivalence of fractions may be used here. For example, the teacher might show a bar diagram with the bar divided into fourths with one fourth shaded, the second divided into eighths with two eighths shaded, etc.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
F. PLACE VALUE AND PLACE HOLDER	Modern Arithmetic Through Discovery (6) Calif. State Series 1965 Pg. 4-5	LEVEL III

The decimal numeral system is a place-value numeral system. The place of the digit in a numeral has meaning - a value is assigned to each place. The numeral 3,487 has four places. The 7 is in one's place, the 8 in ten's place, the 4 in hundred's place and the 3 in thousand's place. The names of the places suggest the values given to the places.
In 9,256, in what place is the 6? the 5? the 2? the 9?

Sample:
The paid attendance at a baseball game was 48,976. This numeral tells the total number of tickets collected.

TODAY'S ATTENDANCE

4	8	9	7	6

1. As the diagram below shows, each digit in the numeral 48,976 has a certain place value.

   4 8 9 7 6

6	The 6 stands for 6 ones.
7 0	The 7 stands for 7 tens or 70.
9 0 0	The 9 stands for 9 hundreds or 900.
8 0 0 0	The 8 stands for 8 thousands or 8,000.
4 0 0 0 0	The 4 stands for 4 ten thousands or 40,000.
4 8 9 7 6	Read the sum. Compare the sum with the numeral at the top.

2. Make a similar diagram to explain this numeral: 51,632.

3. Tell what each digit stands for in the following numerals.
   a. 7,921 b. 34,583 c. 123,604 d. 4,394,540

CONTENT

RESOURCE MATERIAL

Discovering Meanings in Elementary School Math.
By Grossnickle & Brueckner
Holt, Rinehart & Winston
Pg. 70-71

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

4. To make the reading of large numerals easy, the digits are grouped in sets of three, called periods, beginning at the right. Commas are used to separate the periods. The words at the top of this chart name some of the periods.

hundred	ten	one	hundred	ten	one	hundred	ten	one	hundred	ten	one
8	1	5,	7	9	2,	0	4	3,	6	5	3

When we express the number above in words, we use the names of all the periods except the unit's period: "eight hundred fifteen billion, seven hundred ninety-two million, forty three thousand, six hundred fifty three." Read the following.

A. 56,783

B. 120,079

C. 33,576,854

D. 1,456,975,008

E. 492,116,320

F. 781,003,958,632

It is very difficult to read the numeral 371495 when written in the form shown. In order to facilitate ease in reading large numerals we use number periods. Beginning on the right, three consequtive places constitute a period. A comma is used to separate number periods in numerals except in numerals representing dates and telephone numbers.

The first period in our way of grouping numbers is designated as units. The three places in this period are

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

ones, tens, and hundreds.

UNITS		
Hundreds	Tens	Ones

Taken in sequence the names of the next periods to the left of the period of units are; thousands, millions, and billions.

Each period to the left has a value of 1000 times the value of the period to the right.

UNITS		
2	9	1
Billions	Millions	Thousands

= 2,009,001,000

Suggested use in the classroom:

1. Dictated board work through the hundred's place value.
2. Work up into the thousands.
3. Seat work involving adding and subtracting in the area of 999.

999 + 1 = 1,000
999 + 2 = 1,001
999 + 10 = 1,009
999 + 100 = 1,099
999 + 111 = 1,110

} for one thousand

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUE AND ACTIVITIES
		LEVEL III
		4. Same as above for 9,999. for ten thousand.
		5. Same as above for 99,999. for one-hundred thousand.

CONTENT	RESOURCE MATERIAL
G. APPROXIMATIONS & ESTIMATIONS	
See Estimation for Fun	

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

The topic of estimation is seldom thought of as one entirely in the realm of pure mathematics. However, nearly everyone would agree that estimation plays a vital role in the practical application of mathematics.

Point out that estimates should be numbers that are quickly found and that are close to the correct answer.

Provide some interesting estimation activities by displaying a jar of marbles and telling the students they are to try making accurate guesses, or estimates, as to how many marbles are in the jar. Have several students make guesses and discusss various ways they can make good guesses for the number of marbles in the jar.

Estimation for Fun

1. Estimate the number of marbles in this plastic jar.

2. If this block of lead weighs 43 pounds, estimate the weight of this block

3. Count the number of breaths you take in 1 minute.
   Estimate the number of breaths you take
   A. in an hour B. in a 24-hr. day

4. The tallest horse on record is 21 hands tall. Estimate his height
   A. in inches B. in feet

CONTENT

RESOURCE MATERIAL

1. Add-A-Matic

2. Supermarket Ad

1. Daily Newspaper (L.A. Times, Thursday)

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

Teacher will discuss going to the market, selecting groceries, and then not having enough money to pay for them. Probably some of the boys in class are working or have worked as box boys in a supermarket. They will be able to share experiences. Most E.M.R. students have trouble making estimates. This exercise will require much repetition. However, most students will eventually become quite accurate in their estimates.

1. Place supermarket ad on bulletin board.
2. Discuss items on ad to arouse interest.
3. Draw from class and from their needs a shopping list totaling less than $10.00.
4. Make sure slower people know difference between $.01, $.10, and $1.00.
5. Without use of pencil, have them find approximate change from $10.00
   OR
   Read from new shopping list items until they believe they have come close to $10.00.
6. Using hand Add-O-Matic, find exact cost of all items.
7. Using paper and pencil, have students check the Add-O-Matic and their estimates.

1. Using supermarket ads, show how items which are on sale for 39¢, 49¢, 98¢, etc. can be thought of as 40¢, 50¢, and $1.00.

2. Make up shopping lists for each student from supermarket ads. Have students figure approximate needed money for items on list. List will vary according to individual student's ability. Students are to estimate without the aid of paper and pencil.

DEVELOPING THE BASIC ARITHMETIC PROCESSES

Section III

Level III

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
II. DEVELOPING THE BASIC ARITHMETIC PROCESSES		
A. ADDITION		
1. Set Union	Making Arithmetic Meaningful By Brueckner & Grossnickle P. 227-8	There are six stages in the experiences for teaching a basic fact for this level of arithmetic. 1. Show the fact by use of real objects or by pictures of them. 2. Objectify the fact with markers or other manipulative materials. 3. Reproduce the fact by drawings. 4. Write the fact in symbolic form. 5. Verify the fact by use of previously known facts. 6. Use the facts in problems or situations We add to Find: 1. The cost of two things. 2. How many different things there are in all. 3. The sum of two things. 4. How many there are altogether. 5. The amount both had. 6. The total amount. "We add to put numbers together."
(a) Generalization Applied to Sets	Discovering Meanings in Elementary School Math. By Grossnickle & Brueckner Pg. 120-121	A student should be able to discover relationships between the facts in addition and those in subtraction and between the operations if the facts are so grouped that a generalization applies to a set of facts, which may be referred to as a family. A family or set of facts in addition consists of those facts which have a constant sum. The corresponding facts in subtraction constitute the subtraction facts for that family. The facts for the family of 7 are as follows: 3+4=7 7-3=4 4+3=7 7-4=3 5+2=7 7-5=2 2+5=7 7-2=5 6+1=7 7-6=1 1+6=7 7-1=6

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

If the zeros are included, there are two more facts for each operation. The two facts for addition are 7+0=7 and 0+7=7; for subtraction 7-0=7 and 7-7=0.

From the study of the two sets of facts, the following generalizations may be made:

1. Interchange the numbers in a fact does not change the sum. This is the commutative property of addition.

2. One of the numbers in a number pair in each succeeding fact increases by one and the other number in that pair decreases by one.

3. There is no fact in which the two numbers in a number pair are the same. The sum of each number pair is odd. If the sum is an even number, the numbers in one of the number pairs will be the same, as 3+3 in the fact 3+3=6.

4. The number of facts in a family is one less than the number of the family if zeros are not included. If the zeros are included, the number of facts is one more than the number of the family. (For families 11-18, inclusive, the number of facts decreases by one for each family, beginning with 8 facts for a family of 11.)

5. Addition and subtraction are opposite operations.

From the list of generalizations given, it is seen that introducing the number facts in addition and subtraction by families offer ample opportunities for the pupil to discover patterns and relationships which characterizes a set or a family.

CONTENT	RESOURCE MATERIAL
(b) Discovering Patterns Among Sets of Number Pairs	C. L. Thiele, The Contribution of Generalization to the Learning of the Addition. New York: Bureau of Publications, Teachers College Columbia University, 1938

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

Thiele recommended that basic number pairs should be grouped to include the doubles, the near doubles, the 1's, the 2's and 9's, the 0's and the miscellaneous group or set for which a pattern cannot be discovered. The 100 basic number pairs in addition grouped in the six classification given above and the generalization which applies to each set are as follows:

1. The doubles, in consecutive doubles each succeeding sum increases by two.

1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9

2. The near doubles, the sum of a near double is more than the sum of the double in the next lower number pair or one less than the sum in the next higher number pair.

1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9
2	1	3	2	4	3	5	4	6	5	7	6	8	7	9	8

3. The 1's. If 1 is added to a number, the sum is one more than the number.

3	1	4	1	5	1	6	1	7	1	8	1	9	1
1	3	1	4	1	5	1	6	1	7	1	8	1	9

4. The 2's. If 2 is added to a number, the sum is two more than the number.

2	4	5	2	6	2	7	2	8	2	9	2
4	2	2	5	2	6	2	7	2	8	2	9

5. The 9's. Adding 9 to a number is the same as adding 10 to a number then making the sum one less.

3	9	4	9	5	9	6	9	7	9
9	3	9	4	9	5	9	6	9	7

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

6. The 0's. If zero is added to a number or a number is added to zero, the sum is equal to that number.

0	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0
0	0	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9

7. Miscellaneous Set.
The following number pairs and their reverses constitute this set. There is no generalization which applies to the facts in this set.

3	3	3	3	4	4	4	5	5	6
5	6	7	8	6	7	8	7	8	8

The miscellaneous set contains the facts that generally are the source of the most errors in addition because there is no simplifying pattern which pertains to these facts.

2. Using the Number Line

Discovering Meanings in Elementary School Math
By Grossnickle & Brueckner
Pg. 124

One representative way the pupil can identify the addition fact is by the number line. A line extends infinitely in the opposite directions from zero, to represent both positive and negative numbers.

				-						+		
6	5	4	3	2	1	0	1	2	3	4	5	6

The pupil finds the number 3 of the number pair on the number line and then moves his finger or a pointer as many spaces to the right on the number line as indicated by the second number of the number pair.

Have the pupil read the arrangement of his markers or other objects in the opposite order to find the sum . thus; Write the fact on the chalkboard as follows:

3 and 1 are 4 | 1 and 3 are 4
3 + 1 = 4 | 1 + 3 = 4

vertical notation, as, $\begin{array}{r} 3 \\ +1 \\ \hline \end{array}$ or $\begin{array}{r} 1 \\ +3 \\ \hline 4 \end{array}$

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
		The activities included in presenting these addition facts should include: (1) representing the fact with markers; (2) showing the fact on a flannel board or a number line; and (3) writing the fact with symbols.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL III
6. Addition with Two-Place Numbers, Three-Place, etc. (a) Review	Arithmetic Curriculum for Mentally Handicapped	A thorough review of the tens and ones concept must precede introduction to two place addition (See level II). Review of the tens and ones concept and adding two-place numbers (without carrying).
Drills		Dimes can be used to show that two and one are three; two tens and one ten are three tens; 20 and 10 are 30. Teacher directed games such as: "Today we are carpenters and the job we must do calls for 20 and 14 nails. How many nails do we need in all?" Review the concept of tens, ones and hundreds. Two addends of three-place numbers are then introduced, with emphasis being given to the correct use of the terms ones, tens and hundreds.
7. Carrying	Discovering Meanings in Elementary School Math By Grossnickle & Brueckner Holt, Rinehart & Winston P. 144-145	Adding Involving Carrying or Regrouping If a teacher plans to introduce carrying in addition, a problem of the following type may be used to introduce the work: There are 26 chairs in one classroom and 28 chairs in another classroom. How many chairs are in the two classrooms? The teacher should have the pupils discover different ways to find the answer. The class may suggest one or more of the following ways: 1. Begin at 28 and count 26 more. 2. Add 20 and 20 and 6 and 8. The total of 26 and 28 will be equal to 40 +14 or 54. 3. 28 and 10 are 38; 10 more are 48; 2 more are 50; 50 and 4 are 54.

CONTENT

RESOURCE MATERIALS

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

TITLE III

4. 26 is 1 more than 25 and 28 is 3 more than 25. Since 25 and 25 are 50, 26+28 will be 4 more than 50, or 54.

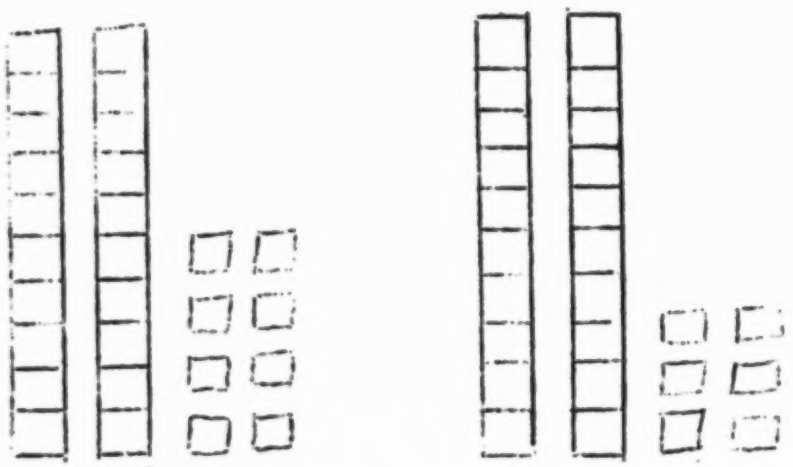
5. Add 26 and 30. The sum is 56. Since 28 is 2 less than 30, the sum of 26 and 28 will be 2 less than 56 or 54.

There are many other ways the class may suggest to find the sum of 26 and 28, such as the use of square and rectangular strips and of place value pockets.

Sequence of Steps in Teaching Regrouping (Carrying) in Addition:

The same sequence used in addition without regrouping applies to addition of 2 two-place numbers with regrouping. The order of the activities for adding 28 and 26 as follows:

1. Have the pupil find the sum by using his square and rectangular strips



CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

2. Demonstrate two examples with a place value chart and make a visual representation of the process at the chalkboard as shown below:

A

TENS	ONES

B

TENS	ONES

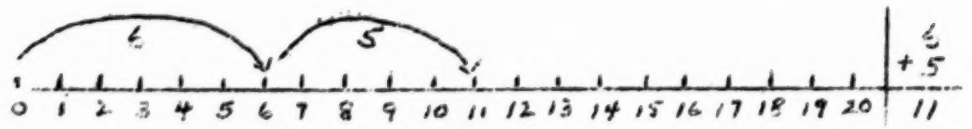
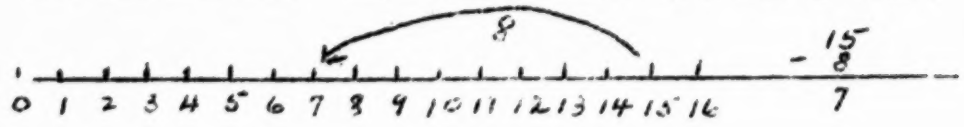
C

TENS	ONES
5	4

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
8. Columnar Addition	Arithmetic Curriculum for Mentally Retarded	3. Write the two numerals in expanded form. $28 = 20 + 8$ $+26 = 20 + 6$ $40 + 14 = 54$ Having reviewed the adding of two-place addends without carrying, three two-place addends are introduced. The skill is then extended to four two-place addends and finally to adding a column with both one and two-place addends. After facility has been developed with two addends, three and then four are introduced. Mixed columns of four addends are practiced and, finally, mixed columns with one, two and three places are introduced. Emphasis must be placed on writing figures in the right column. Further practice can be gained through addition of dollars and cents.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
4. Subtraction with Mathematical Sentences	"Discovering Meanings in Elementary School" - Grossnickle & Brueckner Pg. 184-5	**LEVEL III** For Addition & Subtraction: Eight pupils to participate in the dramatization enter the hallway near the classroom and form 3 unequal groups such as groups of 2, 1, & 5. The first group walks to the front of the classroom followed by 1 pupil, then followed by the group of 5 pupils. The pupils then form one group of eight in a straight line. After a few seconds, this group disbands. Subtraction: The eight pupils line up in front of the class room. Then one group goes into the hallway. The number in the group leaving the line should not be the same as the number in the group remaining. At the completion, the teacher asks the total of each group and then asks volunteers to write a representation with numbers on the board for each, addition & subtraction.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
5. Regrouping or Borrowing	Arithmetic Curriculum for the Mentally Handicapped Sisters of St. Francis of Assisi	Borrowing is introduced following a thorough review of the tens and ones concept. Illustration with concrete objects, bundled sticks, or dimes and pennies is useful.
(a) Borrowing from Tens		The teacher formulates a problem requiring borrowing. Through the use of objects she helps the pupils to see that there are not enough ones in the minuend; she suggests changing one of the tens to ten ones. Use of the "crutch" of crossing out the tens digit and writing the number of tens that are left, and crossing out the ones digit and writing the number of ones there are now, is taught as an aid to understanding and accuracy. One-and two-place subtrahends are used until facility in borrowing from tens is achieved. Three-place minuends are next introduced with borrowing from tens.
(b) Borrowing from Hundreds		Review of the tens and hundreds concept precedes introduction to borrowing from hundreds. Objects are used to illustrate the process. Real money is used in teaching borrowing from the dollars column.
(c) Borrowing from Tens and Hundreds		When the child has mastered borrowing from tens and hundreds as separate operations, the two are combined. After the concept is fairly established, the teacher presents a variety of problems, some requiring borrowing from tens, some requiring borrowing from hundreds, some requiring both, some requiring neither.
	Making Arithmetic Meaningful By Brueckner & Grossnickle Pg 258-9	Supplementary method of showing visually the meaning of re-grouping in subtraction that is helpful, but cumbersome if used by pupils is shown below: $\begin{array}{r} 62 \\ -37 \end{array}$ is written as $\begin{array}{r} \not{6}\,\not{2} \\ -37 \\ \hline 25 \end{array}$ or as $\begin{array}{r} 62 = 50+12 \\ -37 = 30+7\not{2} \\ \hline 20+5 = 25 \end{array}$ After this procedure has been illustrated with several similar examples, the form of regrouping shown at the right should be dropped except for those students who seem to be unable to visualize unseen numbers.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
B. Subtraction 6. Use of the number line	"Arithmetic - Its Structures and Concepts" - Francis E. Mueller	**LEVEL III** At the base of the geometric interpretation of subtraction is the fact that subtraction is the inverse of addition. Thus we should expect that subtraction would reverse whatever addition does on the number line. Addition of 2 numbers was conceived as two steps to the right of zero, with the size of each step determined by the size of each addend. The final resting point, of course, is the sum.  Thus, subtraction starts at the minuend and steps to the left (toward zero) one step the size of the subtrahend. The rest is the remainder. Thus: 

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
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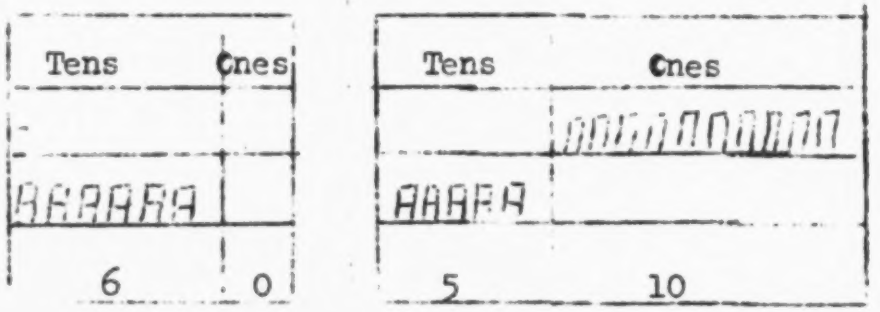
7. Subtraction of Two-Place Numbers, Three-Place, Etc.	Making Arithmetic Meaningful By Brueckner & Grossnickle Pg. 260	When each of these types is first introduced, A: 741 − 228 B: 736 − 142 C: 723 − 146 should objectify the example and find the result with markers, or the abacus, or pocket charts. In the third illustration given, the first 3 is thought of as 13, the next 2 as 11, and the 7 as 6. By the time the pupil is ready to solve examples of this degree of difficulty, he should have had so much experience with the procedure that elaborate thought patterns of "taking", "changing", or "regrouping" are not essential.
8. Subtraction from a Series of Zeros	Making Arithmetic Meaningul	Zero are the source of many errors in subtraction. Most of these errors result from a lack of understanding of the function of zero as a place holder in a number. The kind of elaborate thought pattern just described is almost certain to result in error in subtraction. A difficult example such as 7002 − 1345 should be deferred until the pupil knows how to deal with one or two zeros in three-place minuends. He should not solve the above example until he understands the solution of an example of the type 702 − 145 A student should not attempt to solve an example of the last type until he has understood how to solve an example of the type 60 − 37. The diagram below shows how to regroup 60 as 5 tens and 10 ones. 

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

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When the pupil has achieved mastery in dealing with zero in a two-place number in compound subtraction, he should be able to deal with zero in an example of the type

$$\begin{array}{r} 702 \\ \underline{-145} \end{array}.$$

He can visualize the process by use of place-value pockets which show hundreds, tens, and ones.

When a pupil understands how to deal with the number or problem

$$\begin{array}{r} 702 \\ -145 \end{array},$$

it is not difficult to show the pattern of thought when an extra intermediate zero is used as in the first example above.

In the number 7002, there are 700 tens and 2 ones. If one of the 700 tens is changed to 10 ones, the pupil can see that 600 tens remain. If the pupil understands how numbers may be grouped or regrouped, he should know how to solve any kind of example in subtraction

$$\begin{array}{r} 7002 \\ \underline{-\ 109} \\ 6893 \end{array} \quad = \quad \begin{array}{r} \overset{699}{\cancel{7}}\cancel{0}\cancel{0}2 \\ \underline{109} \\ 6893 \end{array}$$

9. Subtraction of Fractions and Decimals

(a) Sequence

The sequence for teaching subtraction of fractions should be:

1. Subtraction of like fractions: $\begin{array}{r} 3/4 \\ \underline{-2/4} \end{array}$

2. Subtraction of like fractions in mixed numbers without necessity for borrowing: $\begin{array}{r} 2\ 2/3 \\ \underline{-1\ 1/3} \end{array}$

3. Subtraction of mixed numbers with like fractions when the fraction in the minuend is smaller than the fraction in the subtrahend: $\begin{array}{r} 1\ 1/4 \\ \underline{-\ \ 3/4} \end{array}$

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(b) Subtraction of Like Fractions

(c) Subtraction of Mixed Fractions

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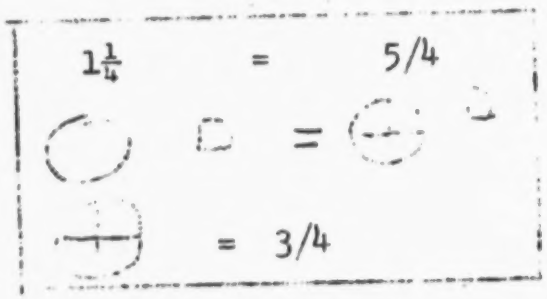
4. Subtraction of unlike fractions: $\begin{array}{r} \frac{1}{2} \\ -\frac{1}{4} \\ \hline \end{array}$

5. Subtraction of mixed numbers with unlike fractions: $\begin{array}{r} 1\frac{1}{2} \\ -\frac{1}{4} \\ \hline \end{array}$

6. Subtraction of mixed numbers with unlike fractions where regrouping is involved: $\begin{array}{r} 1\frac{1}{4} \\ -\frac{2}{2} \\ \hline \end{array}$

Use discs and concrete objects which are divided into fractional parts to teach the concepts of numerator and demonimator and the function of each in the subtraction process.

Subtracting two mixed numbers in which the fraction of the minuend is smaller than the fraction of the subtrahend, the teacher should introduce the process of subtracting two mixed numbers in which the form of the upper number must be changed by using a simple example, such as $1\frac{1}{4} - 3/4$, because an example of this kind is easily objectified on a flannel board. The visualization of the solution of this example is shown below.



$$\begin{array}{r} 1\ 1/4 \\ -\ 3/4 \\ \hline \end{array} \quad = \quad \begin{array}{r} 5/4 \\ -3/4 \\ \hline 2/4 \end{array} \quad = \ 1/2$$

The pupil is able to follow the sequence of steps in the solution and should understand the process.

Then the teacher should give an example in which the

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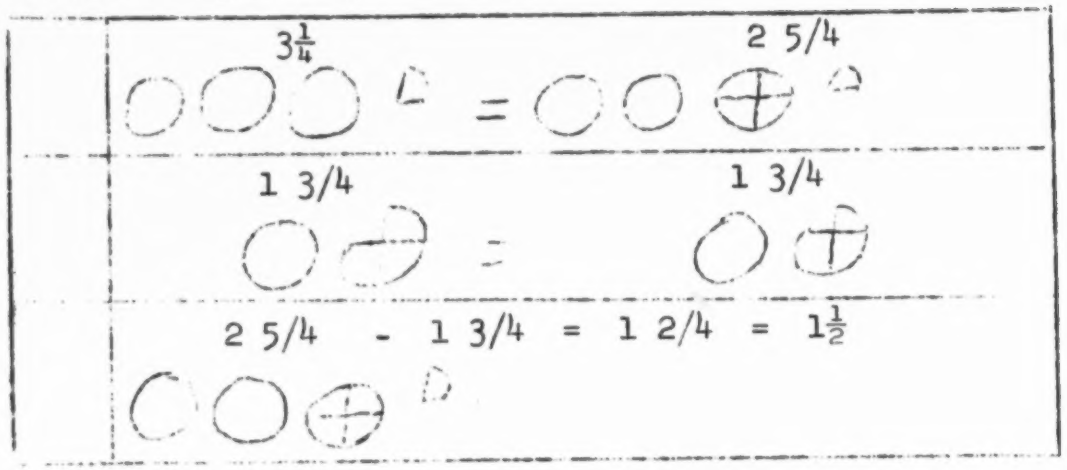
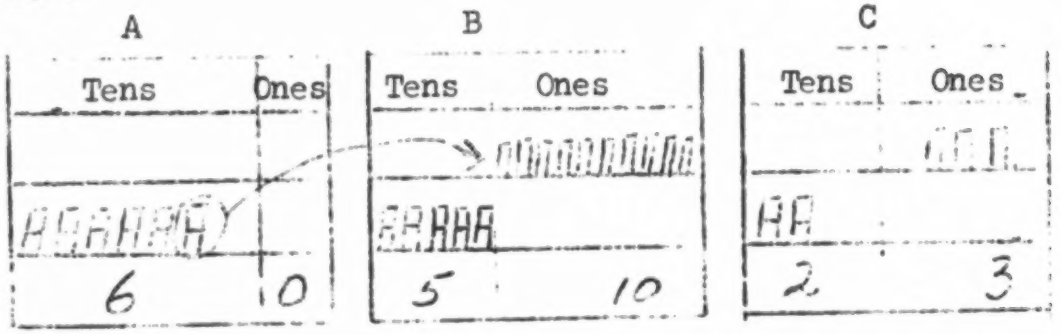
		former example 1 1/4 - 1 3/4.



The class discovers that there is no fractional amount from which 3/4 may be subtracted; hence it is necessary to change one of the wholes to fourths.

(d) Review of Place Value for Subtracting with Decimals

The number 702 is equal to 7 hundreds and 2 ones. This number may be regrouped as 6 hundreds, 9 tens and 12 ones. Finally, the pupil should understand enough about place value to think 702 as 70 tens and 2 ones. Now one of the tens may be regrouped to form 69 tens and 12 ones. Then it is easy to subtract 145 from this regrouped number.



The pupils add and subtract decimals in a manner similar to the way he adds and subtracts whole numbers. It is important for him to discover that the same laws or principles which apply to addition of integers apply to decimals. The students learn in addition and subtraction

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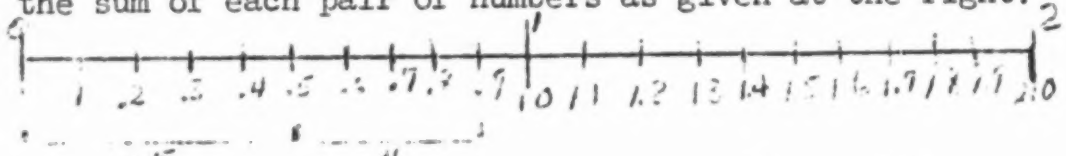
that ones are combined with ones, tens with tens, and the like.

This same principle applies in performing these operations with decimals, hence, tenths can be combined with tenths, hundreths with hundreths, and the like.

The pupil may use his rectangle strips to show how to find the sum of two decimals as .5 and .4 or .7 and .8.

The number line as illustrated also is effective for representing the sum. The pupil writes the decimal numerals in both vertical and horizontal forms to show the sum of each pair of numbers as given at the right.



addition → ← subtraction

$$\begin{array}{r} .9 \\ -.4 \\ \hline .5 \end{array} \qquad \begin{array}{r} 1.5 \\ -.7 \\ \hline .8 \end{array}$$

.9 - .4 = .5 1.5 - .7 = .8
.9 - .5 = .4 1.5 - .8 = .7

Utilize the $ and ¢ concept to teach subtraction of decimals.

$1. and 5¢ = $1.05

Emphasize importance of place value in subtraction of decimals:

$$\begin{array}{r} 7.2 - 2.31 = \quad 7.20 \\ \underline{-2.31} \end{array}$$

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10. Applying subtraction facts to word problems	"Discovering Meanings in El. Sch. Math." - Grossnickle & Brueckner	A very recent technique for helping students solve verbal problems is that of translating each problem into an equation or mathematical sentence. The procedure is illustrated with the following problem: Let us illustrate the procedure with a typical subtraction problem: Betty had 50 cents. She bought a notebook and then had 35 cents left. How much did she pay for the notebook? T: What is the problem question? P: How much did she pay for the notebook? T: With what 2 numbers do we begin? P: Betty had 50 cents at first. She had 35 cents left. We begin with 50 and 35. T: Does the problem tell us how much the notebook cost? P: No; it tells us how much Betty had at first and how much she had left after paying for the notebook. T: What mathematical sentence can we write? P: 50-35 = N, or N = 50-35. P: We could write 35+N = 50 because the money she had left, 35¢ plus the money she paid for the notebook N is 50. T: Both sentences are right. How can we find the number represented by N in the first mathematical sentence? P: Find 50-35. This gives 15. T: How can we find the number represented by N in the second mathematical sentence? P: We would have to subtract 35 from 50 here also. If 35+N = 50, then 50-35 = N or 15. T: What does the 15 tell us about our problem? P: Betty paid 15 cents for the notebook.
11. Subtraction problems in life situations		A. Life situations of subtraction facts is easily reviewed in class by first the verbal sentence, "We have so many of something,

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Subtraction problems in life situations (cont.)

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how many more do we need to have the final sum?" Counting up to a figure seems easier than counting down.

B. Then with the number line we can say "If we have the total of a number and take so much away, how much do we have left?" This can be done in A example and B example with money (change), time (minutes, hours) calendar (days, weeks, months, years) equipment ordering in the room (paint brushes, paper, scissors, etc;) turns in room jobs, especially enjoyed (when does your turn come again?)

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
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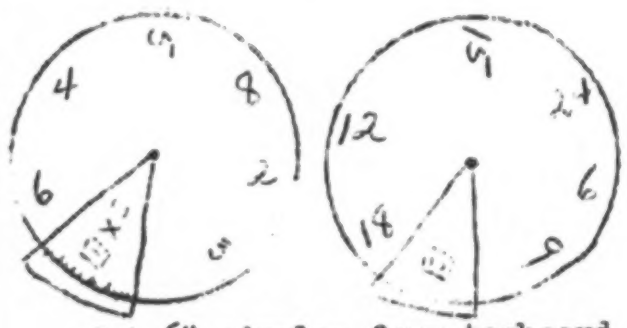
C. MULTIPLICATION		
1. Multiplication As Repeated Addition	Several different kinds of objects which can be used to illustrate grouping.	Utilize the students knowledge of addition combinations to teach the concept of multiplication. $3X3 =$ or $\underset{\times 3}{3}$ means 3 groups of 3. This is the same as $3+3+3 =$ ____ or $\underset{+3}{\underset{3}{3}}$ Have students work with concrete objects to show that multiplication is the same as repeated addition, but gives the answer to problems more quickly: △△△ + △△△ + △△△ = ? One may say $3+3+3 = 9$ or 3 groups of 3 = 9 or $3X3=9$ Use counters, objects, ditto sheets, etc. with many different combinations to firmly establish the concept that multiplication is repeated addition of sets.
2. Multiplication Combinations	Flash Cards Tables of Multiplication facts. Individual practice wheels:  Cut 6" circles from tagboard for each child: One for each	Numerous games and drills to learn multiplication combinations.

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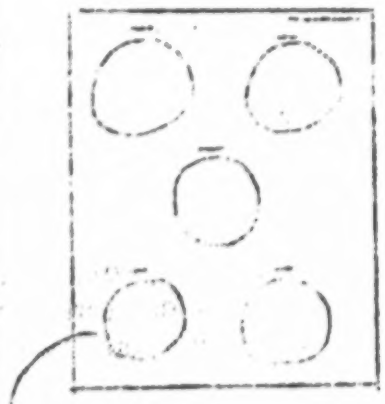
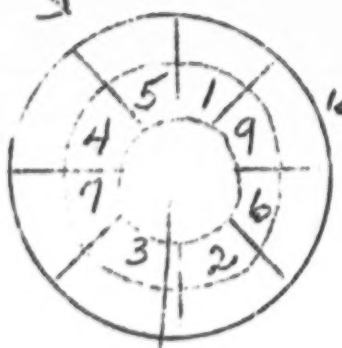
of the tables to be learned.

Movable cover is fastened to circle with brad. Problem appears in window on front, answer on back.

Teacher make ditto sheets which are open ended:



process: (+ - x)



Teacher inserts number and process which is appropriate for

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	individual child. A large number of sheets may be dittoed with appropriate "fill-ins" left blank.	
3. Multiplication Algorithm	Discovering Meaning in Elem. Sch. Math. Brueckner & Grossnickle Pg. 188	One textbook author observed pupils in a fourth-class using the methods illustrated in A and B. A. B. C. 24 24 = 20 + 4 24 x3 x3 x3 x3 12 (3x4) 60 + 12 = 72 72 60 (3x20) 72 Those pupils were supposed to use the adult method shown in C. To find the product of 8 and 78, they performed the operation as shown at the right. 70 8 x8 x8 560 64 560 624 This method eliminated the need for adding by endings as is required in the conventional algorism. To multiply 78x8 in this, the pupil must think: "8x8=64. Write 4 and think 6. 8x7 = 56; add 56 + 6 = 62. Write 62."
	Discovering Meanings in Elem. Sch. Math. Grossnickle & Brueckner Pg. 196	This example shows the conventional algorism for finding the product of 12 and 23. The student may perform the operation in this example without understanding the positional value of each digit, but he would be conscious

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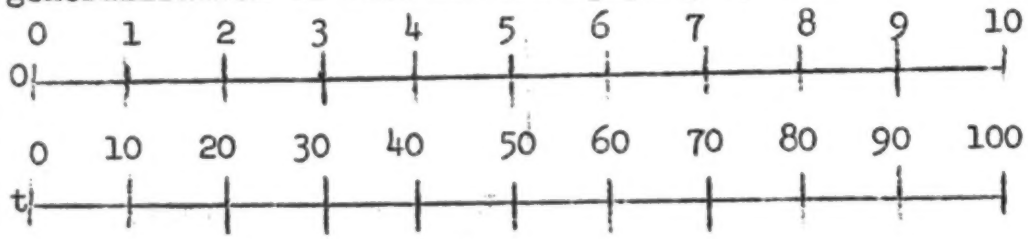
		of the positional value of B and C.
		A 23 x12 46 (2x23) 230 (10x23) 276 B 23 x12 6 (2x3) 40 (2x20) 30 (10x3) 200 (10x20) 276 C 10x(20+3) + 2 x (20+3) = 200 + 30 + 40 + 6 or 276
4. Use of the Number Line in Multiplication	Discovering Meanings in Elem. Sch. Math. Brueckner & Grossnickle Pg 196-7	Give an illustration showing that multiplying by a two-place factor involves multiplying by a one-place number and by a multiple of 10. In order to multiply by a two-place number, it is necessary for a pupil to be able to multiply by 10. The following procedure should enable the learner to discover how to multiply by 10. The pupil can readily discover how to multiply by 10 by counting by 1's and then by 10's or by exploring number lines. Each value in t is 10 times the corresponding value in 0. The pupil should be led to discover that annexing a zero to a number multiplies that number by 10. The teacher should see that the pupil extends this generalization to include multiplying by 100. 
5. Property of C as a Multiplier	Making Arithmetic Meaningful by Brueckner & Grossnickle Pg. 275-6	Zero facts in multiplication are used primarily when multiplying 2 or more place numbers. It is possible to make two "tries" in a game as in pitching horseshoes, and make no score.

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	Discovering Meanings in Elem. Sch. Math Brueckner & Grossnickle Pg. 199	The fact, 2x0=0, is the written record of this experience. On the other hand, it is not possible to multiply by zero: hence there is no fact written in the form 0x2=0. Therefore, there are only 9 facts in multiplication which involve zero. Thus, there are 81 significant facts in multiplication plus 9 zero facts, making a total of 90 basic facts. An example of the following problem shows why the zero of the multiplier should be treated as a place holder. The number 204 is equal to 200+ 4. The pupil multiplies by 4 ones and then by 2 hundreds. Sequence of Learning (a) 423 x204 1692 000 846 86292 (b) 423 x204 1692 8460 86292 (c) 423 x204 1692 846 86292
	Discovering Meanings in Elem. Sch. Math. Brueckner & Grossnickle Pg. 276-7	The zero facts in multiplication should be taught or presented in two-place numbers. If these numbers are objectified in place-value pockets. The pupil will understand the meaning of the zero facts in multiplication. The diagram shows how to represent the example 30 x2 The pupil sees that by multiplying the number of tens by 2 there will be 6 tens. Since there are no ones to multiply, the product is 6 tens or 60. We write the 0 in one's place to keep the 6 in ten's place. Tens | Ones AAA | AAA | 2X3 | 6 Tens | 0 Ones

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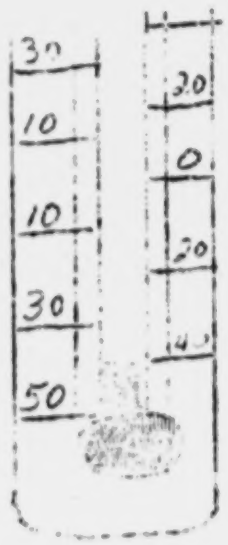
Similarly, other examples are objectified to enable a pupil to generalize about the product of a number and zero. Then the pupil should write each of the 9 zero facts in multiplication.

The teacher must not infer that zero is used exclusively as a place holder. From the illustrations, it is seen that the use of zero is not confined to that of a place holder as in the number 40.



Thermometer

Box Score in BASEBALL										
Visitors	0	0	0	1	1	2	1	0	0	0
Home	0	2	1	1	0	3	0	0	1	X

Box Score in BASKETBALL		
G	F	Points
3	1	7
4	3	11
1	1	3
5	4	14
0	0	0
0	1	1

Score Boards

In multiplication, as in other processes, zero is seldom used as an element of a number grouping. Zero is used predominately as a place holder, as in the example 30

$$\underline{\times 2}$$

but this does not mean that the meaning of a grouping

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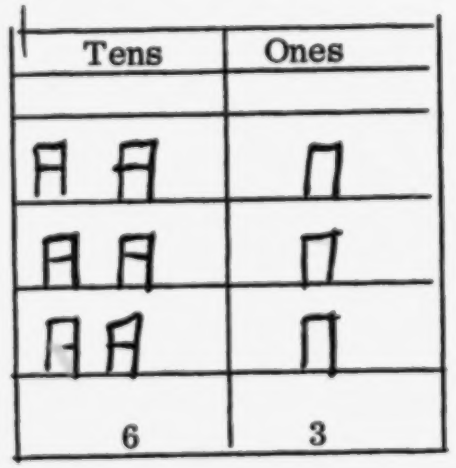
7. Multiplication- one place, two place and three place numbers.	Making Arithmetic Meaningful Brueckner & Grossnickle Pg 288-9	involving zero is not to be learned. There is as much justification for writing the zero facts in multiplication form $\begin{array}{r} 0 \\ \times 2 \\ \hline \end{array}$ as for writing the ones (1's) in the form $\begin{array}{r} 3 \\ \times 1 \\ \hline \end{array}$. It is not necessary to multiply by 1 except in connection with a two or more place number as a multiplier such as 12x36; but the pupil learns the facts involving 1. Multiplication without Carrying: Because of the excellent proctice in the use of multiplication facts, the teacher should introduce at an early stage the solution of multiplication examples in which carrying is not needed as: $\begin{array}{r} 21 \\ \times 2 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 30 \\ \times 2 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 40 \\ \times 3 \\ \hline \end{array}$ The procedure for teaching the solution of any of these examples is similar to the procedure used in teaching addition. The process can be visualized or objectified with place value pockets. For this reason, their usage is recommended. 

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The diagram shows the visual representation of the example 21 .
x 3

The diagram shows that the answer may be found either by adding the number of ones and then the number of tens or by multiplying the number of ones and the number of tens by 3.

The pupil must discover that either procedure may be used because of the relationship of multiplication to addition.

21	10	20	1
x 3	10	20	1
	10	20	1
	10	60	3
	10		
	10		
	60		

60 + 3 = 63 or 21 x 3 = 63

The pupil who understands how to multiply by a two-place factor, should readily understand how to deal with a three place factor, such as 235. The numeral 235 may be expressed in expanded form as 200 + 30 + 5. To multiply in the examples at the right, 413
235
multiply 413 by the total value of each digit. The product of 235 and 413 is the sum of the three partial products. Then combine the three examples as shown in D.

A	B	C
413	413	413
x 5	x30	x200
2065	12390	2065
		12390
		82600
		97055

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8. Multiplication of decimals and denominate numbers	"Arithmetic Curriculum for the Mentally Handicapped" - Sisters of St. Francis of Assisi	Review of the skills involved in the use of the two-figure multiplicand and multiplier is made and then money figures are used in the multiplicand. $ .62 x 18 4.96 6.20 $11.16 Using the form advocated previously, correct placement of the decimal point should present no particular difficulty, since placing decimal points directly below each other will have been previously emphasized. Money in the multiplier is also presented. Three and four digit money figures in the multiplicand are presented as separate skills.
9. Applying multiplication facts to word problems	ibid.	Problems having equal groups with the same label frequently prove confusing. Extended practice in interpreting presented facts may be necessary before the child can independently and accurately ascertain when to add, when to multiply and when to divide. Vocabulary clues might be <u>how much</u> or <u>how many in each</u> (of equal groups); if one item costs, contains, or requires <u>how much</u> or <u>how many</u> would 2, 6, etc., cost, contain or require. The meaning of doubling and tripling is introduced as well as <u>a</u> or <u>an</u> (as in so much an ounce, etc.), <u>each</u> and <u>apiece</u>.
10. Applying multiplication facts to life situations.	ibid.	Problem solving skills introduced in C 9 are practiced for greater facility. Larger numbers are used as growth in skill in the basic processes increases. These problem types are introduced in the context of situations the child is currently encountering. As the child's maturity increases, situations presented focus more and more on situations that will need to be met in adult life, as keeping records of expenditures, totaling grocery bills, restaurant checks, clothing expenses and other bills.

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Data for formulating these problems can be obtained from price lists, newspaper ads, catalogues and menus.

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D. DIVISION 1. Division as repeated subtraction	"Discovering Meanings in Elem. School Math" -Grossnickle - Breuckner 194-195	Children of low intellictual ability can be expected to have less difficulty understanding the process of division if they use the subtraction method rather than the conventional method. Sample: A. 6 2 ⟌ 12 2 ⟌ 12 | 5 10 | 2 | 2 | 1 | 6 B. 58 6 ⟌ 348 30 48 48 6 ⟌ 348 | 300 | 50 48 | 48 | 8 58 C. 50 5 ⟌ 250 25 0 0 5 ⟌ 250 | 20 | 4 230 | 50 | 10 180 | 100 | 20 80 | 50 | 10 30 | 30 | 6 | 50

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SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
LEVEL III

Tony has 60¢ which he received for magazines he sold at 20¢ each. How many magazines did he sell? Teacher may suggest "If we do not know the answer in what different ways can we find it?" The following are some of the ways which the class may suggest:

1. Use money and count with it to find the number of magazines Tony sold.
2. Multiply 20 by some number which will give 60.
3. Add enough 20's to make 60.
4. Subtract 20 from 60 until there is a remainder of zero.

(1)

$$\begin{array}{r} 20 \\ \times\ 2 \\ \hline 40 \end{array} \qquad \begin{array}{r} 20 \\ \times\ 3 \\ \hline 60 \end{array}$$

(2)

$$\begin{array}{r} 20 \\ 20 \\ \hline 40 \end{array} \qquad \begin{array}{r} 20 \\ 20 \\ \hline 60 \end{array}$$

(3)

$$\begin{array}{r} 60 \\ -\ 20 \\ \hline 40 \\ -\ 20 \\ \hline 20 \\ -\ 20 \\ \hline 0 \end{array}$$

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
2. Division as set participation	"Discovering Meanings in El. Sch. Math" Grossnickle-Brueckner Pg. 180-181	The pupil who develops insight into numbers, synthesizes small groups into larger groups and discovers relationships between the smaller and larger groups. There are some unifying ideas or factors common to each table within a family. The 2's, 4's and 8's may be classified in the family or set of 2's; 3's, 6's, and 9's in the family or sets of 3's. The two remaining tables of 5's and 7's cannot be grouped with the other sets of tables. Sample: 2 x 2 = 4 8 x 2 = 16 4 x 2 = 8 2 x 4 = 8 8 x 4 = 32 4 x 4 = 16
3. Division as inverse of multiplication	Brueckner & Grossnickle, "Making Arithmetic Meaningful"	If a pupil can give an answer to a basic grouping in multiplication or division, he does not demonstrate that he has mastery of the fact. Mastery implies understanding of the fact, and also the ability to use it efficiently in the abstract form. Thus, if a pupil gives a prompt response, 12 as an answer to the grouping, 3 x 4, and 4 as the answer to the grouping, 3⟌12, he demonstrates that he can give a correct response to the example in the abstract form. Meaning and understanding, however, cannot be measured in such narrow terms. A pupil understands and masters the fact, 3 x 4 = 12, when he knows how to: a. Find the answer by adding three 4's b. Find the answer by adding four 3's c. Find the answer by relating it to some other grouping involving 3 or 4, as 2 x 4. d. Write the fact in either the horizontal or the vertical form. e. Use it in a problem. f. Relate it to division. g. Give the answer promptly and confidently.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
4. Use of the number line in division	"Discovering Meanings in El. School Math." Grossnickle & Brueckner Pg. 176-177	**LEVEL III** A number line is one of the best ways to enable a pupil to find the quotient of the uneven division facts. The pupil draws a number line as shown and then indicates the numbers that are multiples of the divisor, such as 3, which is used in the illustration. Three and the numbers written below the arrows are factors of the numbers indicated. 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 1 2 3 4 5 The numbers between the multiples are elements of the set of uneven division facts. Thus for the number pair 3⟌11, the number line shows that the quotient must be 3, with a remainder of 2. The pupil uses a number line in the same way that he uses any other supplementary aid. This is an excellent place to start in reviewing division for slow students who have become confused in the division process, especially involving the basic concept of "how many groups?" Example 1⟌2 How many ones are there in 2? This becomes confusing until we say, "How many groups of 1 are there in 2?" This naturally becomes clearer in the problem 2⟌4 or how many groups of (2) in (4)?
5. Property of one as a divisor		
6. Impossibility of dividing by zero		Impossibility of zero as a divisor can be used as a reinforcement lesson for the concept of grouping. T: What does zero mean? P: Zero means nothing by itself. T: If we divide 10 by zero, what is grouped?

CONTENT	RESOURCE MATERIAL
Impossibility of dividing by zero (cont.)	
7. New method of division	"Discovering Meanings in El. Sch. Math" Grossnickle-Brueckner Pg. 194-195
8. Division with one place and two place divisors two place division	ibid.

SUGGESTED TEACHING TECHNIQUES A D ACTIV ..IES

LEVEL III

P: Zero can't be grouped if there is no whole number with it.
T: What happens if we have 10¢ divided by zero?
P: Nothing happens because the 10¢ is not divided by anything.

A study by Van Ensen and Gibb compared the achievement in division of two equal groups in the fourth grade. In one of the groups, the pupils learned to divide in the conventional manner; in the other group, the pupils learned to divide by the successive subtractive method. According to this plan, the pupil used repeated subtraction to find the quotient. Using this method in the example the pupil could find the answer as shown. The quotient is equal to the sum of the numbers in the column at the right, or 26.

Example:

2 | 52	
20	10
32	
20	10
12	
10	5
2	
2	1
	26

There is no fixed pattern of dividing by this subtractive method, i.e.

2 | 52	
40	20
12	
12	6
	26

Tony has 60¢ which he received for magazines he sold at 20¢ each. How many magazines did he sell?

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

Teacher may suggest, "If we do not know the answer in what different ways can we find it?" The following are some of the ways which the class may suggest:

1. Use money and count with it to find the number of magazines Tony sold.

2. Multiply 20 by some number which will give 60.

3. Add enough 20's to make 60.

4. Subtract 20 from 60 until there is a remainder of zero.

(1)	(2)	(3)		
20	20	20	20	60
2	3	+20	20	-20
40	60	40	20	40
			60	-20
				20
				-20
				0

CONTENT

RESOURCE MATERIAL

"Making Arithmetic Meaningful"
- Brueckner, Grossnickle
Pg. 291-292

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

Division by a one-place number may involve even division facts, as in the example $2\overline{)46}$, or uneven division facts as in the example $2\overline{)76}$. In the former case, there is no need for the type of solution shown on the left because each basic grouping is seen. The pupil divides the seen numbers which represent the tens and the ones. The proper solution is shown in the second illustration:

(1)
$$2\overline{)46}$$
$$\begin{array}{r} 4 \\ \hline 6 \\ 6 \\ \hline \end{array}$$

(2)
$$2\overline{)\begin{array}{r}23\\46\end{array}}$$

In the initial stages in the development of division, it is taken for granted that the teacher will stress place value. In the example $2\overline{)46}$, the pupil shows 46 with markers of some kind in place-value pockets. He has 4 tens and 6 ones, and divides each group into two equal parts. The result is 2 tens and 3 ones, or 23.

Suppose there are 34 pupils in the class and they are divided into 2 equal groups. The teacher encourages the class to devise or suggest ways of finding the answer. Some one may suggest that 10 pupils may be put in each group and that would leave 14 pupils to be divided into 2 groups or 7 more for each group making a total of 17 pupils in a group. Some students will capitalize on such a suggestion and give a good solution.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

A.

34 =

Tens	Ones
3	4

B.

Tens	Ones

C.

Tens	Ones
2	14

Tens	Ones
$2\frac{1}{2}$	$2\frac{7}{14}$

CONTENT

RESOURCE MATERIAL

"Making Arithmetic Meaningful"
- Brueckner & Grossnickle
Pg. 288

"Discovering Meanings in El. Sch. Math."
Grossnickle-Brueckner

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

One might wonder why at the initial learning of the uneven facts, the remainder is written as a remainder and not as a fraction. In real life situations, the way to write the remainder depends upon the situation. Each of the following problems illustrates one of three ways to express the remainder:

1. A string 10 ft. long is divided into 3 equal pieces. What is the length of each piece? The length of each piece is 3 1/3 ft. The remainder is part of the quotient.

$$\begin{array}{r} 3\ 1/3 \\ 3\overline{)10}\ \text{ft.} \\ \underline{9} \\ 1 \end{array}$$

2. Ten books are distributed among 3 boys. How many books does each boy receive? Each boy receives 3 books and there is 1 book remaining.

$$\begin{array}{r} 3\ \text{r}\ 1 \\ 3\overline{)10} \\ \underline{9} \\ 1 \end{array}$$

3. If 3 candies sell for 10¢, what is the cost of one candy? In this case, the quotient still is 3 1/2 ¢, but this amount is written as the next whole number, or 4¢.

To reduce the danger of confusion in the early stages of division, the simplest of the three forms should be used in working abstract examples. Since the form in which the remainder is written as a remainder is the easiest and simplest one for the pupils to understand, that form is preferable for abstract examples.

CONTENT	RESOURCE MATERIAL
9. Remainders	"Discovering Meanings in El. Sch. Math." - Grossnickle & Brueckner Pg. 175-176

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

Teaching the Uneven Division Facts:

The pupils should use disks or markers of some kind in order to discover the answer to a number pair in which there is a remainder. To find the number of groups of 2's in 5, he may use 5 disks each and separate them into groups of 2 disks each. The demonstration shows that there are 2 groups with one disk remaining. The number in the remainder is not enough to make a group, therefore the remainder must always be smaller than the divisor. The teacher makes a record of this experience as shown:

$$2\overline{)5}\quad \begin{array}{l} 2 \text{ r } 1 \\ 4 \\ \hline 1 \end{array}$$

In the same way, the pupil uses markers to find other groupings of 2's in which there is a remainder. He continues to use objective materials until he discovers the pattern for writing these facts dealing with the 2's.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL III
11. Applying division facts to word problems		Applying division facts to word problems seems to be the most successful when grouping is explained. Problem = $2\overline{)168}$ T: What are we trying to find in this problem? P: It's a division problem. T: Yes, we are trying to find out how many groups of (2) we find in 168. P: I don;t know how many there are. T: All right, we can put 168 dots on the board and circle each two dots. (this is done) Now do we know how many groups of twos? P: Yes, there are 84. This should start with a small number and work up to a larger number.
12. Applying division facts to life situations		Applying division facts to life situations is particularly easy in a class room, such as: 1. If each row is to have 6 desks in it and there are 48 desks, how many rows will we have? 2. If half of this class gets to use the poster paint first, how many will be painting at one time? 3. The teacher brings 24 cookies for a class of 12. How many cookies does each child get?

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL III
Applying division facts to life situations (cont.)		4. A family spends $100.00 on food each month. There are five people in the family. How much does each use for food?

PRACTICAL APPLICATION OF QUANTITATIVE ABILITIES

Section IV

Level III

CONTENT	RESOURCE MATERIAL
IV. PRACTICAL APPLICATION OF QUANTITATIVE ABILITIES	
A. TIME	"Making Arithmetic Meaningful" Brueckner-Grossnickle Pg. 142-144
2. Telling Time	

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

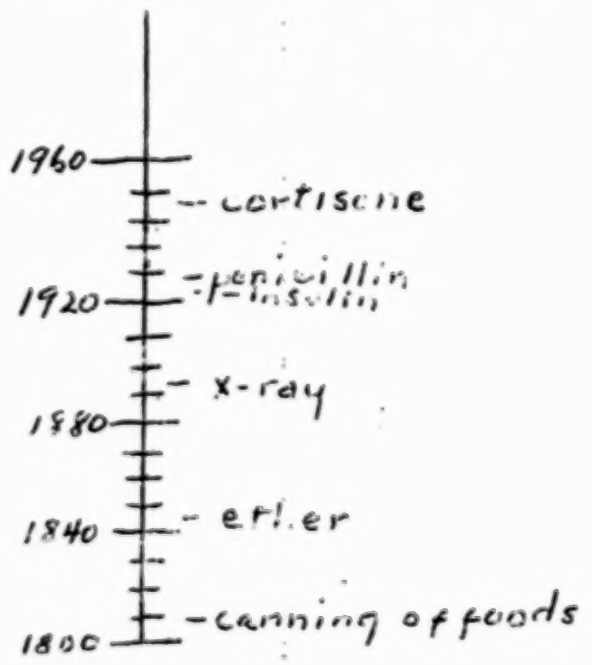
LEVEL III

Unit: Mrs. Grace Schaeffer - Tuttle School, Minn.

Questions:

A. How the world gets its time today
   1. What causes day and night?
   2. Is it night the same time everywhere?
   3. How does the government help us to know the correct time?
   4. How are maps and globes marked to help us to tell the time in different places?
   5. What is meant by "standard time"? When did we adopt standard time?
   6. How many time zones in the U.S.? In the world?
   7. What are the advantages of using standard time?
   8. What is daylight "saving" time?
   9. In what ways do clocks help us to carry on the activities of our daily lives?
   10. How does the Navy tell the time? What is "Navy time"?

B. Uses of numbers and of number processes
   1. Can you read numbers on clocks, calendars, maps, time tables?
   2. How do you tell time with clocks, sun dials, sand glass?
   3. Can you compute or count the differences between dates, hours & minutes?
   4. How are four operations used whole numbers in computing with time measures?
   5. What are the relationships among the different units of time as found by counting or computing?
   6. What are the fractional parts of an hour and how can you express numbers of minutes as parts of an hour?
   7. What is the meaning of technical symbols, such as 1:05, A.M., P.M., and seconds?
   8. Can you measure time gained or lost by a time piece?

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
3. Using the calendar	"Making Arithmetic Meaningful" Brueckner-Grossnickle Pg. 144-45	Questions to initiate a Unit Calendars and their Uses: 1. In what heavenly bodies did the early people notice changes of position? 2. What do we know about the movements of the sun? 3. What changes can we see in the moon? How long is a "moon"? 4. How do the sun and the moon help us to tell time? 5. When did men begin to make calendars? 6. Why were the calendars of different countries not the same? 7. How did the months get their names? 8. What different systems of numbering years are used in other lands? 9. In what ways do clocks help us to carry on the activities of our daily lives?
4. Relating time to life situations	"Discovering Meanings in El. Sch. Mathematics" Grossnickle & Brueckner Pg. 320-321	Questions should be asked in connection with graphs of various kinds to show relationships of time. This can be done in parallel with a number line. 

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

The benefit of this lesson is (1) reading of a graph, (2) relationship of time, (3) integration of social studies and science with math.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
MONEY		LEVEL III
5. Making change		Making change should be done in conjunction with learning that money is constructed arithmetically on a base 10. In the problem Bill has 50¢ and buys something for 30¢, the teacher should make the student aware that from 30 to 50 are 2 tens. Change making can be made simple by starting at this point, then later involving nickels, pennies, quarters, and half dollars. The change should always be counted from the item price up to the amount given. Then it is an addition process instead of the more difficult subtraction. Sample: Item is 31¢. The clerk would count up to 35 in cents, 35 to 40 - one nickel, 40 cents to 50 cents - 1 dime. This separates the functions and as each is done, the student does not go back to the price or have to carry this in his head.
6. Budgeting	Any catalog, as Sears or Speigel Daily Newspaper	A suggested way to start this is a family plan. Let each child pretend he has several clothing needs and is given $20.00. How much can he buy, for what cost, with this money. He must look up the price and item of each article he wants and list this. Nothing must extend over $20.00. The same thing can be done with buying food, given a certain amount each week. The newspaper can be used as a reference. This is good not only for arithmetic but for health (value of food bought) but introducing the Calif. 4% sales tax. Also this brings up questions as how much we should spend on food, clothing, etc.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
11. Checking accounts		LEVEL III A. Use of a checking account can be introduced by a change account for students to borrow from. Teaching of check writing can be done for a record in taking an amount from this fund. Vocabulary of checks must be learned and dittos used to reinforce this material. B. Visits to a bank to understand the concept of a checking account are valuable. C. Using a check statement as an arithmetic enrichment project for the whole class on the board D. Construct a mock bank. Make own checks and records. Issue so much money for each child. Have them write checks and check their account with your records.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
C LINEAR MEASUREMENT		LEVEL III
3. Tools of measurement: ruler, yardstick, tape, etc.	"Discovering Meanings in El. Sch. Math" - Brueckner-Grossnickle Pg. 356-7	Some kinds of measuring devices that should be available in a learning laboratory from which the teacher should make selections are the following: 1. Quantity: abacus, adding machine, number charts, dial telephone, tallying devices, automobile license plates, street numbers, fact finders, counting block. 2. Lengths: ruler, yardstick, tape measure, meter stick, standards for measuring heights, micrometer, pedometer, speedometer, odometer. 3. Time: calendar, clock, watch, stop-watch, sundial, shadow stick, candle clock, hour glass, time table, metronome, school clock system, standard time chart. 4. Value: coins, bills, checks, wampum, tax tokens, stamps, tickets, bonds, price lists, tokens, price tags, cash register. 5. Weight: postal scales, balances, spring scales, nurses scales, grocer scales, druggist scales, pressure gauges, height-weight charts, pictures of scales for weighing large amounts, tables showing weights of things. 6. Area: square inch cards, square foot cards, sizes of rugs, house plans, garden plans, maps. 7. Volume: pint, quart, gal. measurement, cup teaspoon, tablespoon, cooking measures, cans by sizes, peck & bushel, boxes, cases, bottles, water meter, gas meter, rainfall guage, cubic inch block.

CONTENT

1. SOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

8. Temperature: thermometer, clinical thermometer, cooking thermometer, thermostat, automobile temperature gauge, furnace gauge.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
4. Units of measurement: foot, yard, inch, mile, etc.	"Making Arithmetic Meaningful" Grossnickle - Brueckner Pg. 66-67	A. Measuring units 1. ruler - inches, ft. 2. penny: nickel, 5¢, 1¢ 3. thermometer - temperature lines 4. compass - direction, degrees 5. bushel: 4 pecks = 1 bushel B. Units to buy things (by which) 1. quart of milk, 2 pints = 1 qt. 2. dozen eggs = 12 eggs 3. yard of cloth = 3 ft. = 1 yd. , 36 inches = 1 yd. 4. by the peck, potatoes, apples, etc. C. Telling time 1. hours in day - 24 2. PM, AM 3. minutes 4. seconds 5. language of telling time D. Liquid measure 1. marks - measuring cup 2. $\frac{1}{2}$ glass (fractions) 3. 2 pints in quart E. Items related to money 1. knowing 1¢, 5¢, 10¢, 25¢, 50¢ & one dollar as cent, nickel, dime, quarter, half dollars 2. knowledge of cash register 3. making change 4. know how many nickels, dimes, etc.=$1.00 F. Items related to distance 1. depth of water 2. miles on trip (speedometer) 3. measuring tape 4. walking distance

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVIT

LEVEL III

G. Items related to weight
   1. pounds & ounces on a scale
   2. buying something by the ton - 2,000 lbs.
   3. grams & carats of minerals

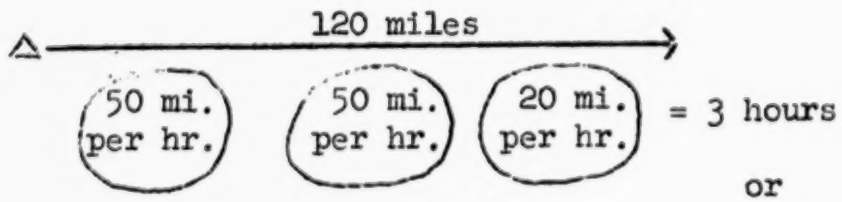
H. Items related to volume or capacity
   1. which is biggest (same shape) of balls?
   2. measuring cup, pail, gallons, pint containers
   3. bushel containers, 52 gallon oil container, city gas supply, etc.

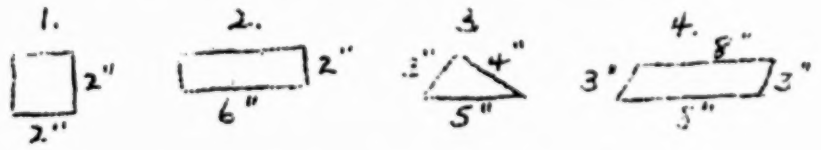
I. Items related to temperature
   1. what is normal human temperature (clinical)
   2. boiling temperature - freezing
      212° 32°
   3. centigrade temperature 0° - 100°

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL III
5. Use of linear measurement in life situations	Discovering Meanings in El. School Math -Grossnickle-Breuckner	1. Laying out & planning a class garden, using a variety of measures such as steps, strings, rulers, and tape measures 2. Using a scale drawn or painted on the wall of the gym to find and compare the heights of several children 3. Making a frieze or mural that will fit into a certain space 4. Marking on the wall the height of various plants as they grow 5. Measuring wood in preparation for construction unit 6. Plotting a room in the home, drawing it at school to scale

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
D. LIQUID AND DRY MEASURE		LEVEL III
4. Use of liquid and dry measure in life situations	"Making Arithmetic Meaningful" - Brueckner & Grossnickle pg. 536-537	The application of various instruments of measurement in concrete situations is an excellent learning activity. A. For weight measurements, some of the instruments students should understand and be encouraged to use are: postal scales, balances, spring scales, nurses' scales, grocery scales, druggist scales, pressure gauges, height-weight charts, pictures of large scales, tables showing weight on purchased canned goods and boxed goods. B. Volumn measurement students should understand: pint, quart, gallon, measures; cup, teaspoon, tablespoon; cooking measures, cans by sizes, peck & bushel measures, boxes, cases, bottles, water meters, gas meter, rainfall gauge, cubic inch blocks.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
E. WEIGHT		LEVEL III
1. Pounds, ounces, tons	"Arithmetic Curriculum for the Mentally Handicapped" -Sisters of St. Francis of Assisi	The child on this level is expected to be able to state his weight with reasonable accuracy and to read a bathroom scale with reasonable accuracy. Discussions involving heavy and light and weight gain and loss are encouraged here. Boys - Periodic gym class weight measurements which are used to establish the boys' components for graduated athletic competition can be used to advantage in the classroom. Components are figured in P.E. once a year; using age, height, and weight. The class could figure them once a week, giving practice in measurement of height and weight and also in addition. Girls - Similarly, the girls P.E. classes compare height to weight for comeliness. Weekly measurements would serve the same end as the above for boys. Pounds, ounces, and tons are most easily taught by deciding what we find that is usually measured in these terms. Pounds (example) - Almost all foods bought in grocery stores must show lbs. & oz. Let class bring a list of things that are just pounds and a list that are smaller and measure in ounces. The ounce measurement must be shown in a relation to a part of a pound. For the ton, discuss railroad car and truck capacities. Use the encyclopedia for description of ships and their tonnage, also a field trip or discussion of interstate commerce scales which stop trucks to assure they are under the max. limit for safety for govt. specifications.
2. Use of measures of weight in life situations	Encyclopedias, newspapers, State Codes (statutes)	

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
F. SPEED 2. Miles per hour	Classified ads in newspapers Speedometer readings Advertising & booklets from new cars from dealers Maps	LEVEL III Introduced with a flannel board and disks to represent speed per hour. Make disks represent trip. Present, for example, a trip of 120 miles across the board. If you travel at 60 miles per hour, how many disks do you need to go 120 miles? Give different students different disks and let them combine them until they reach the 120 miles. These would not have to all be the same. On completing these, the total time could be added to find how long the trip took.  = 3 hours or average mileage = 40 miles per hour

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
G. **GEOMETRIC FORMS** 2. Measures of perimeter and area in life situations	"Discovering Meanings in El. Sch. Math" - Brueckner & Grossnickel pg. 344-345	**LEVEL III** Most textbooks give systematic instruction about the meaning of perimeter and methods of finding the perimeters of surfaces. The measurement can be done with a ruler or a compass. The following exercises suggest a suitable sequence of activities related to perimeters: 1. What is the perimeter of the figures 1 - 4?  2. Use your ruler to measure the L of the side of each figure. Add all sides together. Perimeter of a square = s+s+s+s or 4 times length of one side or P = 4s. Triangle = s+s+s Other activities: Measure P. of class room, perimeter of desks, or any other convenient surface. To develop the concept of area, children should engage in a variety of informal activities before the topic is systematically presented, such as finding the number of squares marked off in a chess board or the number of biscuits or cookies arranged in rows in a pan. They discover the rule that the total number of objects arranged in equal rows is found by multiplying the number in a row by the number of rows: The rule for finding the area of any rectangle may be stated as follows: The area of a rectangle is equal to the product of length and width expressed in the same linear unit. A = lw

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL III

Activities: Cut inch squares. Problem: Find area by using sq. i.e., 3 x 4 rectangle, etc.

Figure area of class room with ruler.

LEVEL IV

DEVELOPING A VOCABULARY OF QUANTITATIVE TERMS

Section I

Level IV

VOCABULARY - LEVEL IV

C. TERMS RELATED TO MATHEMATICAL PROCESSES

account - (1) a record of business transaction; statement of money received, paid or owed. (2) a business relation, especially one in which credit is used, as in "charge account"

allowance

amount - (1) the sum of two or more quantities; total (2) a principal plus its interest. (3) a quantity.

bank

banking

banking balance

bank draft - a draft or bill of exchange drawn by a bank on another bank.

bill of sale

board foot - a unit of measure of lumber. One board foot is one foot long, one foot wide and one inch thick.

bond - (1) An interest bearing certificate issued by a government or business promising to pay the holder a specified sum on a specified date as a school bond. (2) A written obligation under seal to pay specified sums, or to do or not do specified things, as, "A notary has to post a bond." (3) a person acting as surety for another's action; payer of bail as in "bail bond".

budget

business

buy

calories - a unit for meauring the energy produced by food when oxidized in the body: the amount of heat required to raise one gram of water one degree centigrade.

cancel - to strike out common factors.

carrying charges - interest charged by a merchant on the balance owed.

cash

cash discount

cashier's check - a check issued by a bank against its funds and signed by the cashier.

census

certified check - a check that a bank guarantees to be good.

charge

charge account

charge plate

commission

C. TERMS RELATED TO ... (Cont'd)

comprehensive insurance

cost

credit

currency

cylinder

deposit

discount

dollars

down payment

earning

endorse

estimate

fare

finance

gross

horizontal

income

installment

insurance - automobile, fire, liability, life, term.

interest

item

lay away

loans

loss

mark up - to add overhead and profit to the cost of an item in order to arrive at the selling price.

mortgage

net - amount left over after certain deductions or allowance have been made, as for expenses "the net cost" or weight of containers "net weight" or waste materials.

note - any of certain commercial papers relating to the owing of debts or payment of money; as a promissory note, a bank note.

order

overhead

C. TERMS RELATED TO ... (Cont'd)

past due

premium - (1) a reward or prize, especially one offered as an added inducement to win, buy, etc. (2) an amount paid for a loan in addition to interest. (3) the amount payable or paid in one sum or periodically as an insurance premium.

price

profit

promissory note

property

purchase

receipt

rent

sale

sales slip

shop

single

speed

statement

supply

watt

zone

N U M E R A T I O N

Section II

Level IV

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
II. NUMERATION		
B. CONCEPTS OF NUMBERS	1. Numbers and numeral	Number is an abstract idea.
	2. One-to-one correspondence	Numerals are number symbols, which are names for numbers. In counting, there is a one-to-one correspondence between the objects being counted and the set of counting numbers.
C. NUMERAL RELATIONSHIPS Need for symbols money postage stamps tickets shows bus train plane trading stamps	Charles H. Kahn - "Money Makes Sense" - Pacemaker Books, San Francisco	Money is a symbol. Discuss history and meaning of coins, page 1 and 2, "Money Makes Sense". Page 4 - Have each student place coin over picture of coin. Use matching type of game to show quarter is same as twenty-five cents, nickel is five cents, penny is one cent, ten cents is a dime, etc. Page 5 - Students draw line from the name of a coin or the number of a coin to the picture of the coin. Beside picture of the coin, write its name and value.
D. CARDINAL, ORDINAL AND WORD NUMBER RELATIONSHIPS	Cardinal number and ordinal number	The number that tells how many things are in a collection or its size is called a cardinal number. The number that tells the position or order of an object in a collection such as first, second, third, fourth, and so on, is called an ordinal number.
E. READING AND WRITING NUMERALS		Conduct a short discussion period to review place value concepts developed to this point, prepare exercises having students to give the missing numeral. Example a. 3 tens and 3 stands for ( ) 4 tens and 2 stands for ( ) 6 tens and 5 stands for ( )

CONTENT

RESOURCE MATERIAL

F. PLACE VALUE AND PLACE HOLDERS

Post Office - Get Social Security application forms

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

b. 384 means 3 hundreds, ( ) tens, and 4 ones
659 means ( ) hundreds, 5 tens and 9 ones
927 means 9 hundreds, ( ) tens and 7 ones

In the place value scheme, a problem occurs when one gets into five and six digit numerals. Each place is given a new name through the fourth place (the first place is the ones place, the second is the tens, the third is the hundreds and the fourth is the thousands). However, no new names are used after the thousand until one gets to the seventh place, where we give the name millions.

Exhibit on the board several four digit numerals for the students to read. After they have mastered four digits, exhibit five digits and give them an opportunity to read. However, emphasize that the two digits in front of the comma, or to the left of the comma, name the number or thousands.

Each person should apply for Social Security card if he does not have one. Try to help students remember Social Security number by writing at the heading of each paper. Discuss with class ways of breaking down this large number.

Same can be done with telephone number, address, driver's license, license plate on car, etc.

In our system of rotation called the decimal system, ten number symbols - 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 are used to represent all numbers. Our system of writing numerals is built on the base 10.

CONTENT

H. DECIMALS & FRACTIONS

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Emphasize the fact that the number for which a given digit stands depends upon its place in the numeral.

Exhibit a group of pencils or similar objects and give the students an opportunity to group these objects by ten and write the symbol for this number of objects.

Once the concept of ten is mastered, extend the idea that ten groups of ten is extended to groups of 100. Follow this procedure for 1,000, 10,000, 100,000.

During the discussions and demonstrations, continue to stress that 100 is 10 tens, and that 1000 is 100 tens or 10 hundreds.

When a thing or unit is divided into equal parts, the number expressing the relation of one or more of the equal parts to the total number of equal parts is called a fraction.

Review vocabulary used with common fractions and illustrate equivalent fractions by means of diagrams.

Fractions are used to express relationships between numbers. There are three types of relationships:

1. Finding the fractional part of a number;
2. Finding what fractional part one number is of another;
3. Finding a number when a fractional part of it is known.

Review three uses of fractions and provide practice in the addition and subtraction of fractions.

CONTENT

RESOURCE MATERIALS

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

When the numerator and denominator have no common factor except 1, the fraction is in simplest form or in lowest terms.

When the numerator and denominator of any fraction are each multiplied by the same number, except by zero, the result is an equivalent fraction.

Provide practice in finding the largest factor common to both numerator and denominator of a fraction; to express fractions in lowest terms.

We can tell that one fraction is equivalent to another fraction by expressing each given fraction in lowest terms. If the resulting fractions are the same, then the given fractions are equivalent.

A fraction whose numerator is smaller than its denominator is called a proper fraction. The value of a proper fraction is less than one. A mixed number consists of a whole number and a fraction.

A common denominator is a number that can be divided exactly by the denominators of all the given fractions. The lowest common denominator (L.C.D.) is the smallest possible number that can be divided exactly by the denominators of all given fractions.

There is a point on the number line corresponding to each fraction and mixed number.

Provide practice in expressing improper fractions as mixed numbers ; mixed numbers as improper fractions.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
		If two fractions have the same (like) denominators, the fraction with the greater numerator is obviously the greater fraction.
		If the denominators are different, we first express the given fractions as fractions with a common denominator and then take the given fraction that is equivalent to the fraction having the greater numerator and common denominator as the greater fraction. Which is larger?
		Develop an understanding of the procedure for finding the smallest common denominator of two or more fractions.
		Round a mixed number to the nearest whole number by dropping the fraction but adding 1 to the whole number when the fraction is one-half or more. We do not add anything when the fraction is less than one-half.
		Provide practice in adding and subtracting fractions.
		Provide further experience in solving problems.
	Daily Newspaper, Clothing Ads	Look for 1/3 and 1/2 off sales. Show need by showing savings.
	Cook Books	Work out recipes for serving two people, rather than four, as recipes show. Show need for 1/3 cup, 1/2 pint, 1/4 pound, etc.
	Newspaper and Cookbooks	Find cost of preparing meal.
		Show which part of figure is shaded in percent, as fraction and as a decimal.

CONTENT

RESOURCE MATERIAL

Rubber stamps - one of a boy and one of a girl

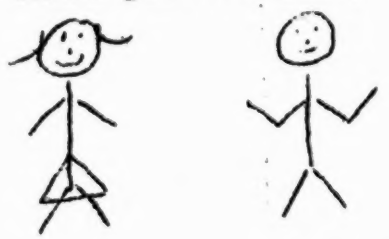
Rubber stamp of circles, squares, rectangles

Pedometer (shows quarter miles and miles)
Two or three for class
(Walter Drake & Sons)
(Appr. cost - $1.00)

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Show which part of group is girls.



Have students shade in these various figures to indicate 1/2, 50 & 50%, 1/4, 50 & 50%, 3/4, 50 & 50%.

Compare this with odometer which uses only tenths and hundredths of mile. Shows clearly fractions of mile, 1/4 mile, 1/2 mile, 1 mile.

On the decimal number scale each place has one tenth the value of the next place to the left. By extending the scale to the right of the ones place, we express parts of one.

Present a method for multiplying integers by fractions or mixed numbers mentally, using the associative and distributive laws.

Read a numeral naming a decimal fraction by reading the numeral to the right of the decimal point as we would a numeral for a whole number and use the name that applies to the place value of the last digit on the right. The numeral may have a zero written in the ones place just preceding the decimal point.

Teach the multiplication of fractions by fractions, using the rule and demonstrate the meaning and advantages of cancellation.

Show that mixed numbers may be multiplied by converting them to improper fractions.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
		Write a numeral naming a decimal fraction by writing the digits as we do a numeral naming a whole number and prefix it with a decimal point so that the name of the part corresponds to the place value of the last digit.
		The value of each place in a decimal numeral may be expressed as a power of ten.
		Express a per cent as a numeral for a decimal fraction, by rewriting the digits of the given per cent by dropping the per cent symbol. Then we move the decimal point two places to the left. A decimal point is understood after the ones digit in a whole number.
		Express a per cent as a numeral for a common fraction by writing the digits of the given per cent as the numerator over 100 as the denominator. Then, if possible, we express the fraction in lowest terms.
		Express a decimal fraction as a per cent by writing the digits of the numeral naming the given decimal. We move the decimal point two places to the right and write the per cent symbol after the numeral.
		A common fraction may be expressed as a decimal fraction and a decimal fraction may be expressed as a per cent.
	Automobile Odometer - one for each student, if possible. Can be obtained from any wrecking yard.	Make large replica of students' odometer. Have students make their odometer read the same as teacher's replica. From this they will find that the 1/10 mile will have to go around 10 times to equal 1 mile. Have them indicate the number of miles this car has gone. Some will say twenty-one and four tenths miles and some will say 21¼ miles. Show which one is right.

CONTENT

(Handling money will be about the only time EMR students will need to use decimals)

RESOURCE MATERIAL

Materials for replica of odometer:
- chipboard
- 6 empty tuna cans
- 1 1" round wooden dowel
- 2 pieces of wood 1/2" x 3" x 2"
- 6 strips of tag board

Add-A-Matic (Walter Drake & Sons Drake Bldg., Colorado Springs, Colo. (appr. cost $1.00)
One for each student if possible.
Supermarket ad

Sears Catalog
Spiegel Catalog
Newspaper ads for cars, etc.

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Have each student write down the actual numbers from parents' cars odometer and report to class.

OR

Have students make replica of odometer.

Directions for making odometer:

Drill or punch 1" hole in bottom of each of six cans. Glue tag board around each can. Divide into ten equal spaces. Number spaces 0 through 9. Put dowel through holes in six cans. Cut hole in chipboard to appropriate size. Drill hole in pieces of wood. Put pieces of wood on dowel. Glue pieces of wood to back of chipboard.

This handy one hand adding machine can help show students the principle of decimals by having them add items purchased in supermarket ad. Be sure they notice where the decimal point is in each price. Each student should add up cost of every item on page of ad.

Pose problem of finding down payment when 10%, 15%, and 20% down is required on items advertised.

Need of finding total selling price when terms are shown . . . Automobile ads are best for this because of high interest. Use of the formula:

Down payment
plus
Trade in
plus
Amount of monthly payment
times
Number of monthly payments
plus balloon payment

DEVELOPING THE BASIC ARITHMETIC PROCESSES

Section III

Level IV

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL IV
II. DEVELOPING THE BASIC ARITHMETIC PROCESSES A. ADDITION 6. Addition with Two-Place Numbers, Three Place, Etc.	Book: Refresher Arithmetic P. 12 Edwin I. Stein Allyn & Bacon, Inc.	Procedure: 1. Place units under units, tens under tens, etc. Stress straight columns. 2. When there are two or more columns of numbers. add each column, starting with the units column. If the sum of any column is ten or more, write the last figure of the sum in the answer and carry the other, figures to the next column. 3. Check by adding the columns in the opposite direction. The students should understand thoroughly the ideas of tens place and the ones place in a two digit numeral before they attempt problems involving carrying in addition. Discuss method A and have students point out the various steps in the exercises.
7. Carrying		Method A Step 1: 37 + 25 = 12 Step 2: 37 + 25 = 12, 50 Step 3: 37 + 25 = 12, 50, 62

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

8. Columnar Addition

LEVEL IV

Discuss method B and C and have students point out the various steps in the exercise.

Method B

Step 1

$$\begin{array}{r} 1 \\ 37 \\ +25 \\ \hline 2 \end{array}$$

Step 2

$$\begin{array}{r} 1 \\ 37 \\ +25 \\ \hline 62 \end{array}$$

Method C

Step 1

$$\begin{array}{r} 37 \\ 25 \end{array}$$

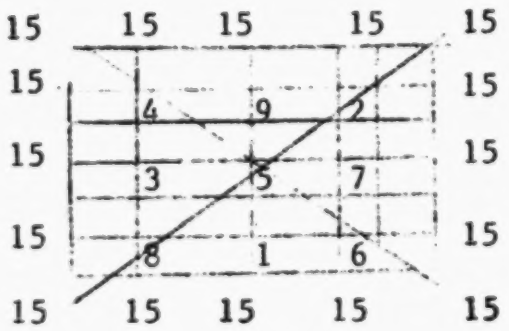
Step 2

$$\begin{array}{r} 30 + 7 \\ 20 + 5 \\ \hline 50 + 12 \end{array}$$ stands for (62)

Discuss with the class how the order and grouping principles are used in column addition so that any two numbers can be added first.

Provide the students with some oral exercises using a magic square to emphasize the rule of the order and grouping principles in column addition.

Example:



Practice column addition: (a) two-place numbers, (b) working with zero, (c) two-place addition and subtraction, (d) three-place numbers, and (e) adding and subtracting three-place numbers.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
9. Addition of Denominate Numbers		Provide practice in finding sums with denominate numbers. Provide practice in liquid measure - - - - - 1 gal. 3 qts. +2 gal. 2 qts. 3 gal. 5 qts. = 4 gal. 1 qt. Provide practice in time - - - - - - 2 hr. 31 min. +3 hr. 40 min. 5 hr. 71 min. = 6 hr. 11 min. Provide practice in linear measure 1 ft. 7 in. +3 ft. 8 in. 4 ft. 15 in. = 5 ft. 3 in. Provide practice in weight 3 lb. 9 oz. +2 lb. 8 oz. 5 lb. 17 oz. = 6 lb. 1 oz. Demonstrate to students the process of reducing the answer to lowest terms.
10. Addition of Fractions and Decimals		Fractions that have the same denominator can be added at once. When fractions have different denominators, they must be changed to equal fractions that have the same denominator before they can be added.

CONTENT

RESOURCE MATERIAL

Book:
"Refresher Arithmetic"
Edwin I. Stein
Allyn & Bacon, Inc.
Pg. 118

Lined ink paper

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Discuss like fractions:

Example:

(a) ½ + ½ = 1 (b) ¼ + ¼ + 3/4 (c) 2/16 + 3/16

Discuss unlike fractions:

(a) 1/2 + 1/3 (b) 2/3 + 1/5 (c) 4/9 + 1/3

It is necessary to write the decimals in columns. Write each addend so that the decimal point is directly under each other. Zeros may be added to the decimal fractions so that the addends may have the same number of decimal places.

Add as in whole numbers.

Place the decimal point in the sum directly under the decimal point in the addends.

Drop extra zeros to the right of decimal point.

NOTE: For those students who have trouble keeping numbers in columns, use lined ink paper with blue lines verticle and the red margin line at the top for heading. All numbers must be between verticle blue lines and no more than one number between verticle blue lines. Decimal points on blue lines.

However, there are some real problems in which the given decimals do not have the same number of decimals places after the decimal point.

Example: .0625 + .25 + .375 + .03125

To find the sum, zeros may be annexed after some of these decimals so that all the decimals will have the same number of decimal places.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
		Example: .0625 .06250 .25 .25000 .375 .37500 .06125 .06125 .74875 And like units are in columns. Then add or subtract as directed, placing the digits of the sum or difference in their proper columns, and place a decimal point in the result in the column of decimal points. Example: $ 24.90 or 24.90 3.25 3.25 80.06 80.06 $108.21 108.21 When decimals represent measures, all the decimals in a problem should be carried out to the same number of decimal places. Example: 23.467 - 4.089
11. Applying Addition Facts to Word Problems	Books: "Refresher Arithmetic" Edwin I. Stein Allyn & Bacon, Inc. Pg. 20-22 Pg. 123 - 125 "Money Makes Sense" Charles H. Kahn Pacemaker Books Pg. 75 - 79	Discuss and have students do several exercises using word problems. Demonstrate the way arithmetic can be used to solve problems connected with road maps.

CONTENT

B. SUBTRACTION

2. As A Comparison of Sets

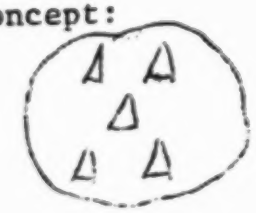
RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Subtraction as a comparison of sets is far more difficult than set separation. The teacher should evaluate students' understanding of this concept.

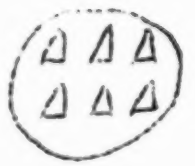
Concept:



is how much greater than

or

is how much less than



Make many applications to life situations:

1. How much less does one earn at $30 per week than at $45. per week?

2. A used car dealer sells 200 cars per year and another dealer sells only 89 cars. How much more business does the 1st dealer do per year?

At the first of the school year find out who has gone on the longest vacation. Compare number of miles of 2 people and location on map. This will show Los Angeles to San Francisco and Los Angeles to Mexico City being a lot different. Help them see "How much different.

This can be repeated for birth places of students, students parents, students grandparents.

Check prices of lunches and dinners. Find out which is more - which is most expensive, least expensive.

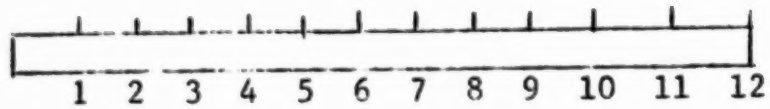
CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
3. Subtraction As Inverse of Addition		Review concepts of inverse processes: If 8 + 7 = 15 then 15 - 7 = 8 and 15 - 8 = 7. Evaluate knowledge of addition and subtraction combinations without use of "crutches" to see if students understand inverse relationship. Show inverse relationship by checking subtraction problems by addition 372 -241 131 + add to check 372
	Using Dollars and Sense, Pg. 98-101	Indicate relationship to life situations: Problems to indicate that expenditures plus savings equal total income ..... and Total income less expenditures equals savings.
4. Subtraction With Mathematical Sentences		Include vocabulary in the activities of the English class to insure that student can read the words of the mathematical sentences: 1. Read the problem. 2. Answer the question, "What does the problem want me to find?" 3. "What information does the problem give that will help me find the answer?" 4. "Which arithmetic process do I use?" 5. "What is the number problem for this word problem?" Give problems with superfluous information.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

6. Use of Number Line

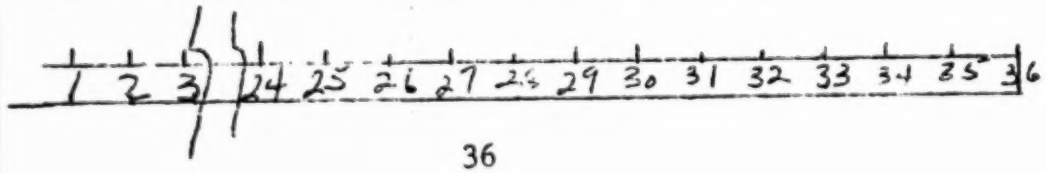
Rulers, yardsticks, tape measures



Utilize commonly used tools of measurement as a number line if secondary students have not mastered the concepts of subtraction. Related problems to adult situations.

Example:

A carpenter has a board 36" long. He saws off an 11 inch piece. How long is the remaining board?



$$\begin{array}{r} 36 \\ -11 \\ \hline 25 \end{array}$$

Review subtraction process:

Evaluate students abilities to perform increasingly difficult subtraction problems:

Step 1 $\begin{array}{r} 436 \\ -215 \\ \hline \end{array}$ $\begin{array}{r} 436 \\ \text{(subtraction with no regrouping)} \end{array}$

Step 2 $\begin{array}{r} 463 \\ -215 \\ \hline \end{array}$ (regrouping necessary in ones and tens column)

Step 3 $\begin{array}{r} 463 \\ -274 \\ \hline \end{array}$ (regrouping necessary in all columns)

Relate subtraction of large numbers to life situations:

1. Develop with the students problems about payroll deductions: (a) health insurace, (b) social security tax, (d) union dues and (d) income tax.

7. Subtraction of Two-Place Numbers, Three-Place, etc.

"Using Dollars and Sense"
Fearon Publishers
Pg. 91-93

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

8. Subtraction From a Series of Zeros

2. Reproduce check books and reconcilement statement. Write checks and determine balance - -

Car payment
Rent
Food
Utilities bills
Gasoline credit card

Reconcile bank statement

Review students' understanding of zero as a placeholder and regrouping procedure

tens	ones
□□□□	
4	0

tens	ones
□□□	□□□□□ □□□□□
3	10

Make application to a series of zeros

hundreds	tens	ones
4	0	0

=

hundresds	tens	ones
3	10	0

=

hundreds	tens	ones
3	9	10

Apply to subtraction problems

$$\begin{array}{r} 400 \\ -286 \\ \hline \end{array} = \begin{array}{r} 3\ 10\ 0 \\ -2\ 8\ 6 \\ \hline \end{array} = \begin{array}{r} 3\ 9\ 10 \\ -2\ 8\ 6 \\ \hline 1\ 1\ 4 \end{array}$$

9. Subtraction of Fractions and Decimals

Refer to Level III for sequence in subtraction of fractions, page 168.

Apply the place value concept to positions to the right of the decimal point.

tens	ones	.	tenths	hundredths

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Review decimal fractions using money as a tool:

1¢ = .01 of a dollar
10¢ = .1 of a dollar

Discuss rule:

When subtracting numbers containing decimals, the decimals must be kept in a straight line.

Sequence of problem types:

1. Straight computation - no regrouping

$$\begin{array}{r} \$1.98 \\ -\ .20 \\ \hline \end{array}$$

2. Regrouping of tenths and hundredths columns

$$\begin{array}{r} \$1.62 \\ -\ .47 \\ \hline \end{array}$$

3. Regrouping of all columns

$$\begin{array}{r} \$3.00 \\ -1.42 \\ \hline \end{array}$$

4. Recognizing place value in decimals

Forty-two cents take away three cents

$$\begin{array}{r} .42 \\ -.03 \\ \hline \end{array} \qquad \text{not} \quad \begin{array}{r} .42 \\ -.3 \\ \hline \end{array}$$

5. Proper grouping for computation

3.21 - .321 =

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
10. Applying Subtraction Facts to Word Problems		**LEVEL IV** Develop word problems related to life situations which involve each of the concepts previously taught. Problems should be given in the following sequence: 1. Word problems containing numerals and no superfluous information. John earned $39.00 and spent $18.00. How much money did he still have? 2. Problems containing word numbers A can of brand A corn costs twenty three cents. Brand B is on sale for eighteen cents. How much is saved by buying brand B? 3. Problems containing superfluous information Bill is going to buy a used car. He found a Ford for $275.00 and a Chevrolet for $315.00 including sales tax. License plates for both cars cost the same - $11.00. How much more would he have to pay for the Chevy?
11. Subtraction Problems in Life Situations	Using Dollars and Sense Fearon Publishers, Inc.	Make application of basic subtraction skills in numerous life situations: 1. Figuring change 2. Comparing cost of grocery items 3. Analyzing advertising and sales 4. Buying a car 5. Budgeting 6. Checking accounts 7. Payroll deductions 8. Comparing gasoline mileage 9. Getting the most for your money 10. Borrowing money etc. Present to students many situations drawn from their experiences and assist them in converting these situations into the proper mathematical form.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
C. MULTIPLICATION		
6. Multiplication by 10's and 100's		It is important to paint out the relationship between 0 and 1 and a multiplier. Discuss that when 0 is a factor the product is 0. Have several students choose a number and multiply by 0/ Have class review the 100 multiplication facts by completing the multiplication table.

x	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9						
4	0	4	8		16					
5	0	5	10			25				
6	0	6	12				36			
7	0	7	14					49		
8	0	8	16						64	
9	0	9	18							81

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
8. Multiplication of Decimals and Denominate Numbers		With the student who shows signs of successfully understanding, have them study the examples: 23 x 46 = (20 x 46) + (3 x 46) Step 1: 46 x23 138 — Step 2: 46 x23 138 920 — Step 3: 46 x23 138 920 1,058 3x46 = 138 20x46 = 920 138 + 920 = 1,058 Provide students with supplementary exercises Emphasize the products 1/10 x 1/10, 1/10 x 1/100 and 1/100 x 1/1000 for the students. Have the students do several exercises using decimals. When they have finished allow time for checking papers and further discussion. Be sure to give the student an opportunity to discuss how they were able to arrive at the placement of the decimal point. Introduce a method for finding the product of two rational numbers given in decimal notation. Attempt to develop skill in finding the product of two rational numbers given in decimal notation. Allow the students to discuss any facts they wish. Try to provide problems around the class discussion.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
10. Applying Multiplication Facts to Life Situations		Example: 1. 2 basketball teams, 5 players on each team, how many players? 2. 2 basketball teams, 4 cheerleaders for each team, how many cheerleaders? 3. Double header baseball game, each game 9 innings, how many innings? 4. Basketball game; 4 quarters, 8 minutes each quarter, how many minutes? The basic multiplication skills can be applied to many life situations: 1. Cost of multiple items when cost of one is known. 2. Computing cost of interest and carrying charges on loans and credit buying. 3. Weekly salary when paid by the hour. 4. Distance, time, speed when traveling. 5. Increasing recipes (doubling, tripling). 6. Total cost when unit cost is given (3 yards of cloth at $1.29/yard.) 7. Computing total when denominate numbers are involved (a man worked 6 hours, 20 minutes per day for 5 days - - - -) 8. Finding areas, perimeters and volume, etc.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL IV
D. DIVISION 7. New Method by Division		Explain that division is used to find the number by which to multiply a divisior to give the dividend as a project. An exact divisor of a whole number is a factor of that number. Example: 3 is a factor of 12 4 is a factor of 12 6 is a factor of 12 2 is a factor of 12 Explain the fundamental division combinations: Example: 4x8=32 therefore 32 ÷ 4 = 8 and 32 ÷ 8 = 4. Encourage students to use estimation in arriving at quotients.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
9. Remainders		Solution (Remainder) $\begin{array}{r} 56 \text{ r } 3 \\ 7\overline{)395} \end{array}$ Explanation: 1. 395 ÷ 7 = 56 r 3 Means 395 can be divided into 56 groups of 7 with 3 left over. Check Does 7x56+3=395? When there is a remainder - dividend = divisor x quotient + remainder.
10. Division of Decimals		Solution $\begin{array}{r} 5.46 \\ 6\overline{)32.76} \end{array}$ Explanation: 1. 32 ÷ 6 = 5r2. Write 5 over 2 of 32. Carry the remainder 2. 2. Annex 7 to 2 (carried) making 27. 27 ÷ 6 = 4 r 3 write 4 over 7, carry 3. 3. Annex 6 to 3 (carried) making 36. 36 ÷ 6 = 6 r 0 write 6 over 6 of 76 Check. Does 6x5.46=32.76?

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
11. Applying Division Facts to Word Problems		Develop an approach to word problems: Is it a problem which calls for the division process? What is the dividend? What is the divisor? Does the problem require more than one arithmetic process? Does the problem give information which is not pertinent?
12. Applying Division Facts to Life Situations		Utilize the division process in life situations related to: wages, interest costs, car payments, cost per unit when total cost is given, budgeting, determining ones "fair share", etc.

PRACTICAL APPLICATION OF QUANTITATIVE ABILITIES

Section IV

Level IV

CONTENT	[illegible]	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
V. PRACTICAL APPLICATION OF QUANTITATIVE ABILITIES		
A. TIME		
4. Relating Time to Life Situations	Time clock as found in factories.	Students are to "punch in" each morning. End of week, find how much each students being late would cost him.
	Policies as found in local industries Re: late to work, lunch time, break time, etc.	Show how to find break time, lunch time and quiting time.
		Explain a time clock.
		Go over time-and-a-half and other overtime pay.
	Using Dollars and Sense Pgs. 53 & 54	Using one of your students, find how much money he has earned in a week. This will help students to: 1. Figure minutes and hours, as an example, a boy works as a bus boy for $1.00 per hour, from 4.15 PM to 10:15 PM. Show how this is 6 hours or $6.00. This can be expanded to the limit of individuals in your class.
B. MONEY		
5. Making Change		1. Set up "Bank" by having students "contribute" lunch money, etc. This money will be returned at end of period. Put record of "Deposits on blackboard. Try to get as many as possible to contribute.
		2. Teacher will "sell" small items such as pencil for 3¢ to student. The student will pay for this with a dollar given to him from the bank. Teacher will count back change ... "That's 3¢, 4¢, 5¢, 15¢, 25¢, 50¢, $1.00. Then the teacher and student will exchange places and repeat procedure.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
6. Budgeting		
a. Developing a Knowledge of Concepts Related to Sources of Income		Discuss the following concepts: Wages of the individual (father, mother) from full time employment. Supplementary income earned from part-time employment of the wife and children. Supplementary income earned by husband on secondary jobs. Other sources of income; pension, interest, unemployment compensation, relief (Department of Public Assistance) and insurance benefits.
b. Developing a Knowledge of the Proportionate Role in the Total Budget Areas of Expense		1. Saving - expenses owed to oneself 2. Rent or payment on house 3. Food 4. Clothing 5. Household - furniture, repairs, and appliances 6. Health - doctor, dentist, medicine. 7. Insurance - life, medical, auto and household 8. Recreation - vacation 9. Contribution - church, civic organization 10. Transportation - auto, car pool, bus fare 11. Family allowances - spending money for the family 12. Gifts - birthdays, weddings and shower gifts 13. Miscellaneous - newspaper, magazines. Discuss: Characteristics of merchandise which determine value, i.e. workmanship, quality of materials. Relationships between value and cost, i.e. the best for the money. Concept of the "sale", "special", etc. and their advantages and disadvantages.

LEVEL IV

FAMILY BUDGET—EXPENSES

	Per Week	Per Month	Per Year
FHA Home payment	$	$	$
Gas & Electricity			
Water			
Garbage Pick-up			
Food			
Clothing			
Bus Fare			
Medical and Dental			
Church			
Household Repair and Replacement			
Personal Allowances			
Emergency			
Recreation			
TOTAL			

Possible savings per year . . . . . $ _____

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
		Read and discuss catalogs and advertisements relative to purchases to be made in light of value and wise buying. Draw up a list of projected purchases ranking best buys. Estimate preparation of income designed for common financial obligation for luxuries. Establish budget and determine purchasing power for variously priced items as a cash payment or time payment purchase. Compute saving gained by purchasing at sales and discount prices. Individual preparation of a personal record of income and expenses for a two week period by each student based on a weekly allowance of five dollars. Teacher and class analysis of the merit of these budgets. Class preparation of a hypothetical budget for the following families. 1. Single, employed male or female, living with family. 2. Husband and wife - husband employed, no children. 3. Husband and wife - two pre-school children. 4. Husband and wife - no children - both husband and wife work.
7, Banking		Vocabulary and comprehension of the following banking services: 1. Money, its origin, form, need and function 2. Checking account-substitute for money. 3. Saving accounts (banking, saving and loans). 4. Loans - auto, home, furniture and medical. 5. Mortgages 6. Appraisal 7. Trust funds

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
		8. Traveler's checks 9. Bank money orders 10. Bank drafts 11. Certified checks 12. Cashier's checks 13. Postal saving 14. Saving Bonds 15. Promissory notes
		Make a field trip to a local bank for introduction to orientation of banking services.
		Secure a speaker from either a local saving and loan association or bank to explain agency services.
		Create a bulletin board display to illustrate the various banking forms.
		Maintain a hypothetical checking account over a period of time showing a deposit and checks written.
		Knowledge and skills necessary to use the following bank services.
		Checking Accounts: Opening the account, signature card, bank investigation, selection of type checking system. (joint, pay by check, service charge).
		Discuss the procedure necessary to open a checking account. (Initial deposit).
		Secure from a bank an application for opening an account and have students investigate the forms. Make samples of the signature card and have the class fill in the information.
		Discuss information following the outline for knowledge and skills necessary for banking services and have class maintain a hypothetical checking account.

CONTENT

RESOURCE MATERIAL

General Business For Everyday Living
R. L. Price
McGraw Hill
Pg. 72-90

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Making deposits: using deposit slips, depositing checks, endorsing checks, making entries in passbook, entering deposit on current personal bank balance.

Writing checks: explain to class how to pay bills by personal checks. Using ink or machine, observing proper check-writing techniques, subtracting amount of check from existing bank balance to establish new balance. Understanding the penalties for overdrawing one's account or issuing checks against non-existent accounts.

Have class calculate and balance a checking account.

Discuss how to stop payment on a check.

Discuss with class the service charges on a checking account.

Bank Statement: value of cancelled checks as receipts, balance between bank statement and personal check book stubs, bank service charges on checking accounts, route of checks through clearing houses.

Determining validity of check. Determining responsibility for payment of bad checks.

Saving Accounts: Discuss how to open a savings account. Have students fill out a signature card. Discuss the various types of savings accounts; (Savings and Loan, payroll deduction, Postal Saving, Christmas Club, Trustee for Children)

Making deposits: Each individual who has a savings account has a passbook in which deposits are entered by the teller at the bank. To make a withdrawal a withdrawal slip must be filled in and signed by the individual.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
		Loans, Mortgages and Promissory Notes: a. Analyzing loan sources for best service. b. Locating correct department or person to discuss loan. c. Having pertinent information: 1. Purpose of loan 2. Employer - job - income 3. Collateral 4. References 5. Method of payment 6. Credit rating d. Learning which should be secured by applicant: 1. Length of loan 2. Interest rate 3. Total amount to be repaid 4. Mortgage refinancing e. Knowing legal obligation and responsibilities: 1. Penalties for failure to meet payment. 2. Contract content 3. Procedure to follow in case of inability to meet payments.
9. Taxes	Property Tax Statement	Compute the property tax for one or two pieces of property. This will be for more capable E.M.R. High School students. Have students compute actual dollar and cents paid for each tax, that is, elementary school, high school, library, police, city streets, city government, personal property, etc.
	Income Tax Instruction Forms	Work out each student's income tax with him in class. This can be one of the most rewarding lessons at the senior high level. Most students will have a refund due them. This makes even more interesting. CAUTION: Be sure you have all W-2 forms for the student before starting.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
10. Credit	Local Department Stores will supply credit application forms (May Co., Broadway, Sears, Penneys, etc.)	Explain "why have credit". Invite member of credit staff of a local store into class to discuss importance of credit. Have him explain reasons for keeping good credit rating. Have him explain also, reasons for the information requested on credit application. Credit applications should be filled out in class. Go over need and reasons for each item of information requested. Evaluate and give credit rating to each of these completed credit applications.
	Used Car and New Car Ads in Paper	Show how to find total cost of a car. Some ads will show down payments and monthly payments and number of months. Have students work out total cost of each car.
	Pad of "Conditional Sales Contracts"	Show how person buying car can get in trouble by buying a car for $3,500.00 $500.00 Down in cash 300.00 Trade in $800.00 Total down payment $2,700.00 Balance to be financed over two years. 432.00 Finance cost. $3,132.00 Total to be financed. $130.50 payment per month for two years. Payments are made for one year ... $1,566.00 will be paid in. Payment is late and car is repossessed. Show clause in Conditional Sales Contract. Car is then sold by Finance Company for $1,000.00. There is still owed $1,566.00, therefore, there is

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

is a deficiency balance of $566.00. This must be paid by the person who bought the car originally.

Show total cost:

$ 800.00	Down payment
1,566.00	Paid in
566.00	Deficiency balance
$2,932.00	Total cost for car for one year.

plus loss of credit rating.

STORY OF TWO CARS

A man went into the car dealer and found two cars he liked. The cars were alike in every aspect, even to color. The body style was the same. They had the same size engine. In no way could there be any difference noticed.

On questioning the salesman, he was assured there was no difference, except in price. One cost $333.00 and the other cost $648.00. Which one would you buy?

The same situation is true of buying things on time. We must pay interest. Interest is like renting money. Here is an example of two types of interest, both at 6% for three years:

Simple interest	$3,600.00 @ 6% 3 years	$648.
Unpaid balance only	$3,600.00 @ 6% 3 years	$333.

On one the borrower pays only on each months balance, the other the borrower pays on the full amount of the loan for three years.

CONTENT

RESOURCE MATERIAL

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

CHART

$3,600.00	1st month	$100	+ $18.00	interest
3,500.00	2nd month	100	+ 17.50	interest
3,400.00	3rd month	100	+ 17.00	interest
3,300.00	4th month	100	+ 16.50	interest
3,200.00	5th month	100	+ 16.00	interest
3,100.00	6th month	100	+ 15.50	interest
3,000.00	7th month	100	+ 15.00	interest
2,900.00	8th month	100	+ 14.50	interest
2,800.00	9th month	100	+ 14.00	interest
2,700.00	10th month	100	+ 13.50	interest
2,600.00	11th month	100	+ 13.00	interest
2,500.00	12th month	100	+ 12.50	interest
2,400.00	13th month	100	+ 12.00	interest
2,300.00	14th month	100	+ 11.50	interest
2,200.00	15th month	100	+ 11.00	interest
2,100.00	16th month	100	+ 10.50	interest
2,000.00	17th month	100	+ 10.00	interest
1,900.00	18th month	100	+ 9.50	interest
1,800.00	19th month	100	+ 9.00	interest
1,700.00	20th month	100	+ 8.50	interest
1,600.00	21st month	100	+ 8.00	interest
1,500.00	22nd month	100	+ 7.50	interest
1,400.00	23rd month	100	+ 7.00	interest
1,300.00	24th month	100	+ 6.50	interest
1,200.00	25th month	100	+ 6.00	interest
1,100.00	26th month	100	+ 5.50	interest
1,000.00	27th month	100	+ 5.00	interest
1,300.00	28th month	100	+ 4.50	interest
800.00	29th month	100	+ 4.00	interest
700.00	30th month	100	+ 3.50	interest
600.00	31st month	100	+ 3.00	interest
500.00	32nd month	100	+ 2.50	interest
400.00	33rd month	100	+ 2.00	interest
300.00	34th month	100	+ 1.50	interest
200.00	35th month	100	+ 1.00	interest
100.00	36th month	100	+ .50	interest
			$333.00	

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL IV
11. Checking Accounts		All students who have jobs should be encouraged to open checking accounts. It will be far better to do this than to try to use simulated checking accounts. However, if it is impossible, use simulated checking accounts. Most important to keep stub and reconcile with bank statement.
C. LINEAR MEASUREMENT 1. Awareness of distance		Provide some information concerning the historical development of our units of linear measure. Develop some appreciation of standard units of measure and their relations to one another. Center the preparatory activities around reading and discussion because measurement concepts can be explored best through physical activities, it is imperative that students be given an opportunity to make considerable use of various material in class activities. Have students guess the length and width of the classroom. Explain that the choice of a unit of measurement is based on convenience, depending upon the size of the object to be measured. We can select any unit we please to measure a given object, but if we wish to communicate with others concerning this measurement, they must know the unit used.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL IV
2. Self Measurement		Give the students an opportunity to compare their growth. Draw a line on the board and have several students guess whose height would reach the mark.
3. Tools of measurement a. Ruler b. Yard stick c. Tape		Before presenting materials on the tools of measurements, give the students an opportunity to talk about their methods of determining the length of such objects as a belt, a hat, a pencil, paper clips, etc. Provide the students with an opportunity to handle the various devices that might be used for measurement such as a wire, a cardboard square, or a wooden block. Cut pieces of string a foot long, a yard long and six feet long. Have a member of the class compare string with the measurement instruments.
4. Units of Measurement a. Inch b. Foot c. Yard d. Mile		Discuss by using the body as a tool for measurement, how the joints on the fingers compares to an inch, that from the finger tips to elbow is apporximately one foot and from wrist to wrist is about a yard. Have the class suggest which unit would they choose to measure: The finger, a pencil, the distance from Compton to Long Beach, a spoon, the width of the room.
5. Use of Linear Measure in Life Situations		Acquaint the student with the meaning of precision in measurement. Provide practice in measuring with a ruler. Compare readings of measurement units. Learn to use non-standard units such as paceing off. Use a variety of simple terms to estimate and measure a given distance or quantity.

CONTENT	RESOURCE MATERIAL
E. WEIGHT	
1. Pounds, Ounces Etc.	
2. Use of Measures of Weight in Life Situations	Scales Tape Measure Newspaper grocery Advertisements

SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES

LEVEL IV

Teach relationships of measures of weight.

16 ounces = 1 pound
2000 pounds = 1 ton

Utilize the basic processes in problems with denominate numbers involving weight:

1 lb. 12 oz.	4 lb. 2 oz.
+2 lb. 8 oz.	-2 lb. 8 oz.

Provide many problems involving estimation of weight and comparison of the weight of objects.

Comparison of weight of cars as it relates to.

gas mileage, speed, stopping distance

Recognition of weight of self and others as a factor in:

sports, clothing, health.

The use of weight in recipes:

1/4 lb. butter, 1/2 lb. meat, etc.

Recognizing weight in grocery shopping. comparing price values by weight of the object to be purchased.

Example: which is the better buy - -

A 12 oz. package of hot dogs for 60¢ or a 1 lb. package for 69¢?

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES LEVEL IV
F. SPEED		
1. Time Required for Particular Tasks		Estimate and compare actual time involved in performing given tasks: Changing a tire, walking a mile, cutting a lawn, repairing an electrical plug, getting ready for school or work, reading one page in a book.
2. Miles per Hour	Road Map	Give problems related to travel time to a given destination at different speeds: Fresno is 200 miles from Los Angeles. How long would it take to make the trip at 50 miles per hour? at 60 miles per hour? Explain the concept of "average speed".
3. Sports Records	Newspaper - Sport page List of school records	Compare times in dashes and distance races. Compare school records to world records. Relate time in track events to miles per hour. Compare one's own time before and after training.
4. Horsepower and Speed		Discuss relationship of power, weight and speed. Read about automobile races. Compare horsepower of race cars and cars for regular use. Compare speed of cars, jet planes, roxkwra qirh power developed by each kind of engine.
5. Speed in Life Situations		Discuss methods of travel to various destinations and relationship of time to speed of travel. Give problems involving piece-work and rate of pay.

CONTENT	RESOURCE MATERIAL	SUGGESTED TEACHING TECHNIQUES AND ACTIVITIES
		LEVEL IV
		Relate speed of personal movement to time required for accomplishment of tasks.
G. GEOMETRIC FORMS		
1. Recognition and Relationships		Develop the ability to recognize simple plane figures (e.g. circles, square, triangle, rectangle) in the environment, using correct names and noting their interior and exterior regions. Develop ideas of points, lines, and points on a line. Cut out, draw, color geometric designs. Explore ways of drawing lines through a series of points to form figures. Work out patterns for games, such as a circle or square. Construct a right angle, using a template. Construct parallel and perpendicular lines informally and plane figures. Demonstrate how a string representing a radius can be used to make a circle.
2. Measure of Perimeter and Area in Life Situations		Provide practice with the compass and straight edge and demonstrate a method of constructing a circle, a square and a triangle. Measure and compute perimeters and areas of geometric figures. Relate these concepts to life situations: length of fences. square yards of carpet for a room. number of square feet of wall space to be painted.

CONTENT	RESOURCE MATERIAL	SUGGESTED [illegible] AND ACTIVITIES
		LEVEL IV
		number of square feet of lawn to be planted or fertilized. amount of concrete mix needed to pour a driveway.
II. TEMPERATURE		
1. Reading the Thermometer	Outside thermometer Room thermometer Oven thermometer Medical thermometer	Explain method of calibrating thermometers. Explain numbering on various thermometers. Provide practice in reading each of the different kinds of thermometers. Relate readings to comfort zones, to proper cooking temperature and to human temperature.
2. Boiling and Freezing Point		Make students aware of temperatures at which water freeze and boil Relate boiling and freezing points of water to those of other materials. Discuss the effect of these temperatures on: cooking, cars, sports, plants.
3. Body Temperature		Learn to read medical thermometers. Discuss implications of body temperature which deviate from normal. Relate temperature reading to the necessity for securing medical care.